

Workshop Manual

Audi A6 2011 ➤

Audi A7 Sportback 2011 ➤

TDI injection and glow plug system (6-cyl. 3.0 ltr. 4-valve common rail)

Engine ID	CLAA	CLAB	CDU C	CGQ B	CKV B	CDU D	CKV C	CPN B	
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Edition 11.2013

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List of Workshop Manual Repair Groups

Repair Group

23 - Mixture preparation - injection

28 - Glow plug system

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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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23 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003646; Edition 11.2013)

⇒ [“1.1 Safety precautions when using testers and measuring instruments during a road test”, page 1](#)

⇒ [“1.2 Safety precautions when working on vehicles with start/stop system”, page 2](#)

⇒ [“1.3 Safety precautions when working on the fuel system”, page 2](#)

⇒ [“1.4 Safety precautions when working on the injection and glow plug system”, page 4](#)

⇒ [“1.5 Checking vacuum system”, page 4](#)

1.1 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

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1.2 Safety precautions when working on vehicles with start/stop system

When performing repairs on vehicles with start/stop system, note the following:



WARNING

Risk of injury due to automatic engine start on vehicles with start/stop system.

- ◆ *On vehicles with activated start/stop system (this is indicated by a message in the instrument cluster display), the engine may start automatically on demand.*
- ◆ *Therefore it is important to ensure that the start/stop system is deactivated when performing repairs (switch off ignition, if required switch on ignition again).*

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1.3 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:



WARNING

The fuel can become extremely hot. This can cause injuries.

- ◆ *In extreme cases the fuel lines and the fuel can reach a temperature of 100 °C on vehicles with common rail engine, even after the engine is switched off. Allow the fuel to cool down before disconnecting the lines - danger of scalding.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*

Risk of injury - fuel system operates under pressure.

- ◆ *If the battery is not disconnected, the fuse for the fuel pump control unit - J538- must be removed as a precautionary measure before opening the fuel system because the fuel pump will otherwise be activated by the contact switch on the driver's door.*
- ◆ *Wrap a clean cloth around the connection before opening the fuel system. Then release pressure by carefully loosening the connection.*
- ◆ *Wear protective gloves.*
- ◆ *Wear safety goggles.*



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

To prevent the high-pressure pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ *To prevent the high-pressure fuel pump from running while it is empty and to ensure that the engine starts quickly after parts have been renewed, it is important to observe the following:*
- ◆ *If components of the fuel system between the fuel tank and the high-pressure fuel pump are removed or renewed, the basic setting "Checking fuel system pressurisation pump" must be performed to bleed the fuel system.*
- ◆ *Perform first fuel filling after installing high-pressure pump.*

- Clean tools and workbench etc. before working on the injection system.
- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- When removing components, plug all open connections immediately with suitable clean sealing caps.
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be re-used in new, sealable plastic bags.
- Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be re-installed on the same cylinder.
- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.

- When the engine is running, do not perform any repairs to the common rail system.
- Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- When the fuel system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.

1.4 Safety precautions when working on the injection and glow plug system

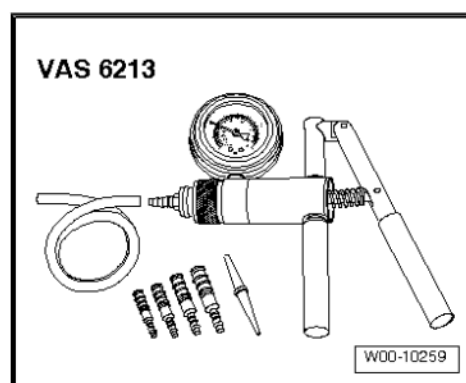
To prevent injuries to persons and/or damage to the fuel injection and glow plug system, note the following:

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as piezo systems and xenon headlights.
- ◆ Always switch off the ignition before connecting or disconnecting tester cables or electrical wiring for the injection or glow plug system.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.
- ◆ Certain tests may lead to faults being detected and stored by the engine control units. Therefore the event memory must be interrogated after completing all tests and repair work ("Interrogate event memory").

1.5 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking

- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If an entry is stored in the event memory, check the vacuum lines leading to the corresponding component, and also check the remaining vacuum lines leading to other components.
- If it is not possible to build up a vacuum with the hand vacuum pump - VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.



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2 Injection system

⇒ ["2.1 Overview of fitting locations - injection system \(CLAA, CLAB, CDUC, CKVB, CPNB\)", page 6](#)

⇒ ["2.2 Overview of fitting locations - injection system \(CGQB\)", page 15](#)

⇒ ["2.3 Overview - fuel system", page 26](#)

⇒ ["2.4 Filling and bleeding fuel system", page 27](#)

⇒ ["2.5 Connection diagram - vacuum system", page 28](#)

2.1 Overview of fitting locations - injection system (CLAA, CLAB, CDUC, CKVB, CPNB)

Engine compartment

1 - Radiator outlet coolant temperature sender - G83-

- ☐ Fitting location
⇒ [page 13](#)
- ☐ Removing and installing
⇒ Rep. gr. 19

2 - Right electrohydraulic engine mounting solenoid valve - N145-

- ☐ Removing and installing
⇒ Rep. gr. 10

3 - Air mass meter - G70-

- ☐ Removing and installing
⇒ [page 80](#)

4 - Pressure differential sender - G505-

- ☐ Fitting location
⇒ [page 12](#)
- ☐ Exploded view
⇒ [page 90](#)

5 - Exhaust gas temperature sender 4 - G648-

- ☐ Exploded view
⇒ [page 90](#)

6 - Engine speed sender - G28-

- ☐ Exploded view
⇒ [page 100](#)

7 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing
⇒ Rep. gr. 26

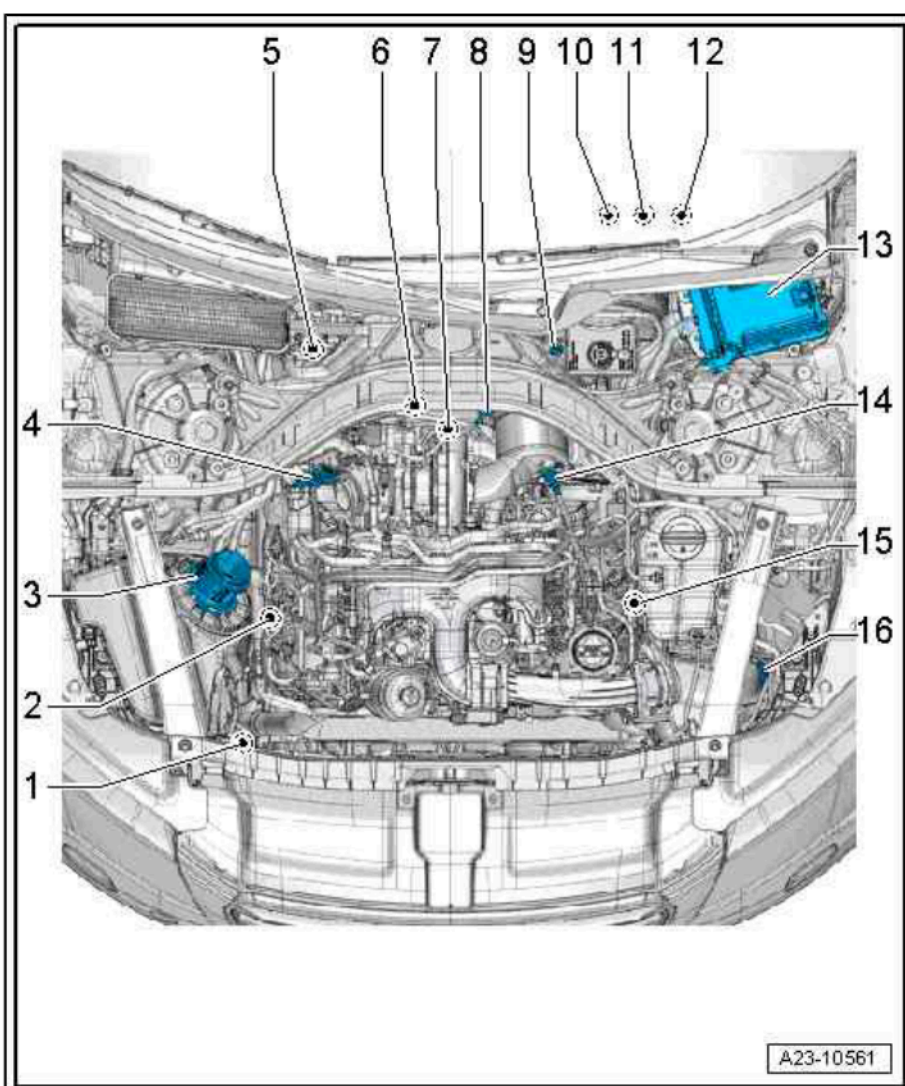
8 - Exhaust gas temperature sender 3 - G495-

- ☐ Exploded view ⇒ [page 90](#)

9 - Brake servo pressure sensor - G294-

10 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ☐ Fitting location ⇒ [page 11](#)



11 - Instrument cluster with control unit in dash panel insert - J285-

- ☐ Removing and installing ⇒ Rep. gr. 90

12 - Brake light switch - F-

- ☐ Fitting location ⇒ [page 11](#)

13 - Engine control unit - J623-

- ☐ Fitting location ⇒ [page 11](#)
- ☐ Removing and installing ⇒ [page 98](#)

14 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Exploded view ⇒ [page 90](#)

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15 - Left electrohydraulic engine mounting solenoid valve - N144-

- ☐ Removing and installing ⇒ Rep. gr. 10

16 - Charge pressure sender - G31- / intake air temperature sender - G42-

- ☐ Fitting location ⇒ [page 12](#)

Engine (top view)

1 - Fuel pressure regulating valve - N276-

- ☐ Exploded view
⇒ [page 44](#)

2 - Injector, cylinder 1 - N30-

- ☐ Exploded view
⇒ [page 44](#)

3 - Glow plug 1 - Q10-

- ☐ Exploded view
⇒ [page 100](#)

4 - Injector, cylinder 2 - N31-

- ☐ Exploded view
⇒ [page 44](#)

5 - Hall sender - G40-

- ☐ Fitting location
⇒ [page 12](#)
- ☐ Exploded view
⇒ [page 100](#)

6 - Glow plug 2 - Q11-

- ☐ Exploded view
⇒ [page 100](#)

7 - Injector, cylinder 3 - N32-

- ☐ Exploded view
⇒ [page 44](#)

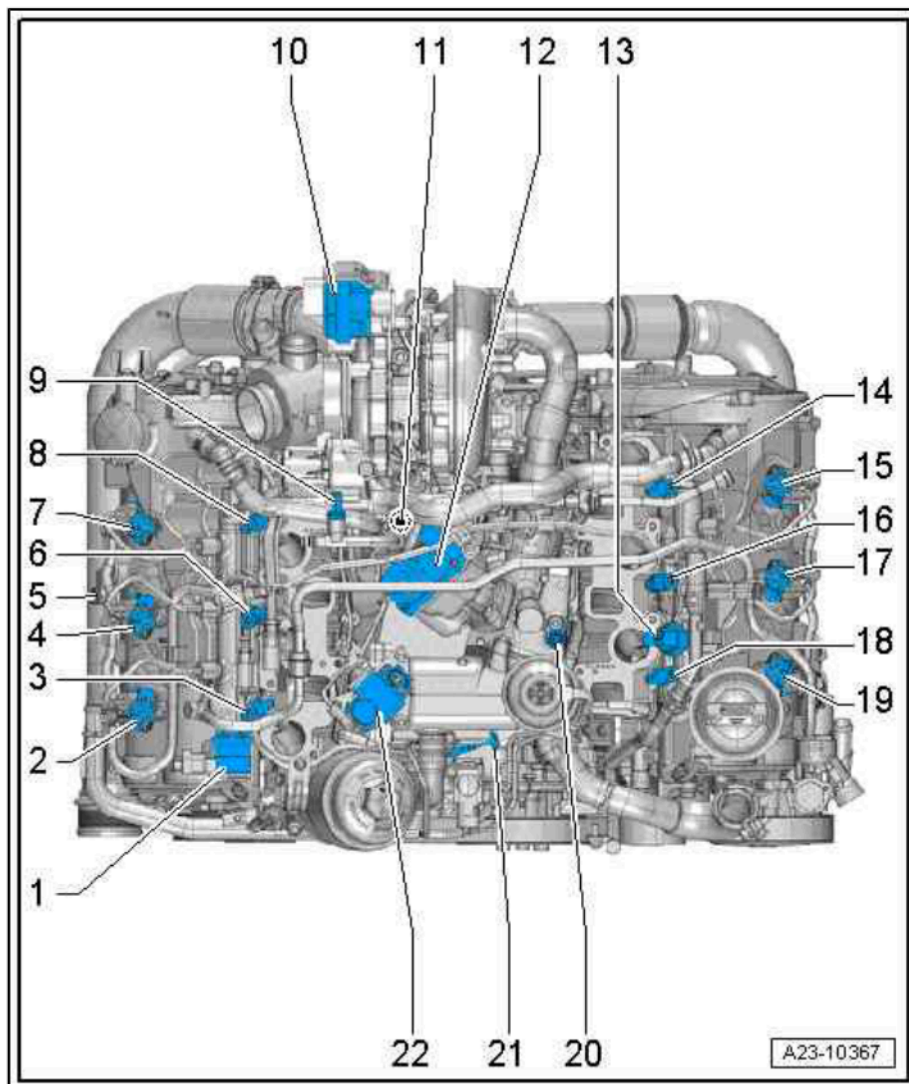
8 - Glow plug 3 - Q12-

- ☐ Exploded view
⇒ [page 100](#)

9 - Fuel temperature sender - G81-

10 - Control unit for turbo-charger 1 - J724-

- ☐ On turbocharger
- ☐ Removing and installing ⇒ Rep. gr. 21





11 - Fuel metering valve - N290-

- ☐ Fitting location ⇒ [page 12](#)

12 - Exhaust gas recirculation control motor - V338-

- ☐ Removing and installing ⇒ Rep. gr. 26

13 - Fuel pressure sender - G247-

- ☐ Removing and installing ⇒ [page 85](#)

14 - Glow plug 6 - Q15-

- ☐ Exploded view ⇒ [page 100](#)

15 - Injector, cylinder 6 - N84-

- ☐ Exploded view ⇒ [page 44](#)

16 - Glow plug 5 - Q14-

- ☐ Exploded view ⇒ [page 100](#)

17 - Injector, cylinder 5 - N83-

- ☐ Exploded view ⇒ [page 44](#)

18 - Glow plug 4 - Q13-

- ☐ Exploded view ⇒ [page 100](#)

19 - Injector, cylinder 4 - N33-

- ☐ Exploded view ⇒ [page 44](#)

20 - Coolant temperature sender - G62-

- ☐ Removing and installing ⇒ Rep. gr. 19

21 - Exhaust gas recirculation temperature sensor - G98-

- ☐ Removing and installing ⇒ Rep. gr. 26

22 - Coolant valve for cylinder head - N489-

Engine (front view)

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1 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
 ⇒ Rep. gr. 17

2 - Map-controlled engine cooling system thermostat - F265-

- ☐ Removing and installing
 ⇒ Rep. gr. 19

3 - Oil temperature sender 2 - G664-

- ☐ Fitting location
 ⇒ [page 13](#)
- ☐ Removing and installing
 ⇒ Rep. gr. 17

4 - Oil pressure switch - F22-

- ☐ Removing and installing
 ⇒ Rep. gr. 17

5 - Oil pressure switch for reduced oil pressure - F378-

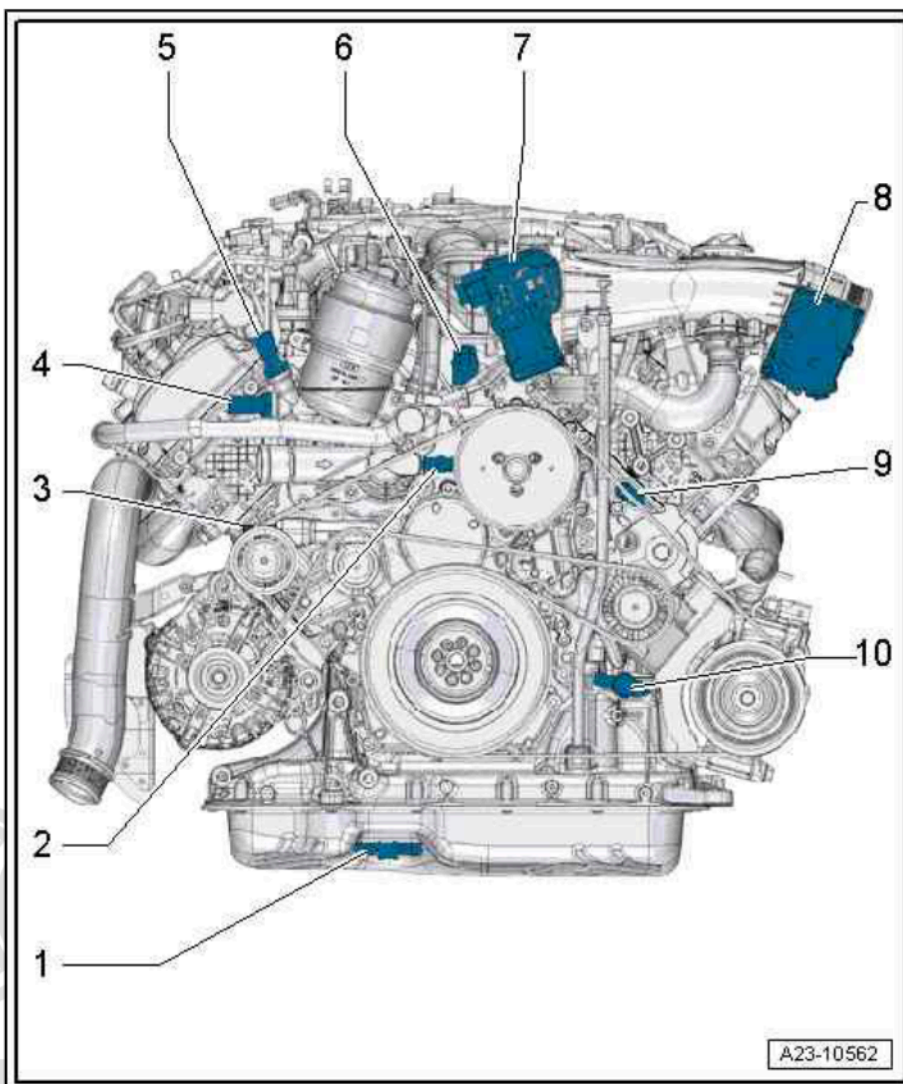
- ☐ Removing and installing
 ⇒ Rep. gr. 17

6 - Exhaust gas recirculation cooler change-over valve - N345-

- ☐ Removing and installing
 ⇒ Rep. gr. 26

7 - Intake manifold flap motor - V157-

- ☐ Exploded view



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⇒ [page 35](#)

8 - Throttle valve module - J338-

- ☐ Exploded view ⇒ [page 35](#)

9 - Temperature sender for engine temperature regulation - G694-

- ☐ Fitting location ⇒ [page 13](#)

10 - Valve for oil pressure control - N428-

- ☐ Fitting location ⇒ [page 13](#)
- ☐ Removing and installing ⇒ Rep. gr. 17

A - Fuel pump control unit - J538-

- ☐ Fitting location ⇒ [page 11](#)

B - Injector for reducing agent - N474-

- ☐ Only fitted on vehicles with SCR catalytic converter
- ☐ Fitting location ⇒ [page 14](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

C - Control unit for NOx sender 2 - J881- and NOx sender 2 - G687-

- ☐ Only fitted on vehicles with SCR catalytic converter
- ☐ Fitting location for engine code CKVB ⇒ [page 14](#)
- ☐ Fitting location for engine code CPNB ⇒ [page 15](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

D - Control unit for NOx sender - J583- with NOx sender - G295-

- ☐ Only fitted on vehicles with SCR catalytic converter (engine code CPNB only)
- ☐ Fitting location ⇒ [page 15](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

E - Control unit for reducing agent metering system - J880-

- ☐ Only fitted on vehicles with SCR catalytic converter
- ☐ Fitting location ⇒ [page 14](#)

F - Exhaust gas temperature sender 4 - G648-

- ☐ Only fitted on vehicles with SCR catalytic converter
- ☐ Fitting location ⇒ [page 14](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

G - Exhaust gas temperature sender 2 - G448-

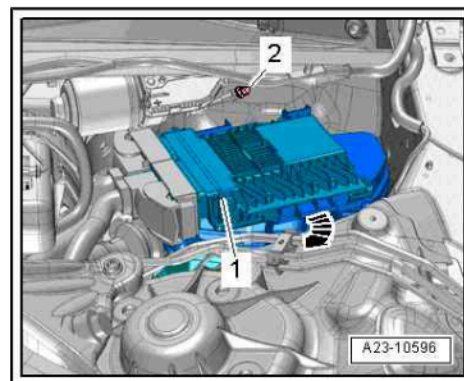
- ☐ Only fitted on vehicles with SCR catalytic converter (engine code CPNB only)
- ☐ Fitting location ⇒ [page 14](#)
- ☐ Removing and installing ⇒ [page 93](#)

H - Particulate sensor - G784-

- ☐ Only fitted on vehicles with SCR catalytic converter (engine code CPNB only)
- ☐ Fitting location ⇒ [page 14](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

Fitting location of engine control unit - J623-

- ◆ -Item 1- in plenum chamber (left-side)



Fitting location of accelerator position sender - G79- / accelerator position sender 2 - G185-

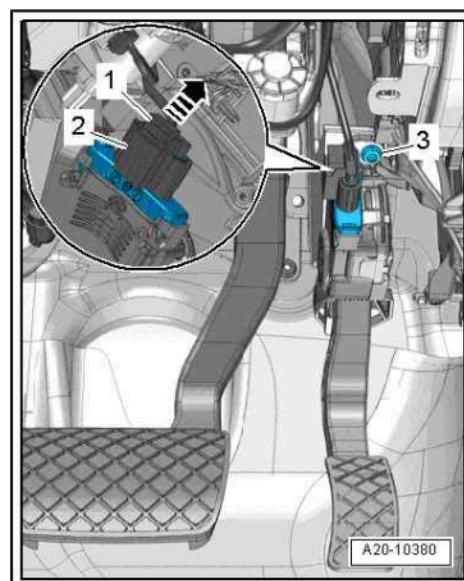
- ◆ In accelerator pedal module



Note

The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

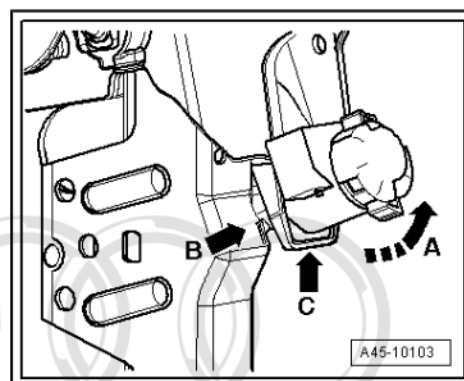
Removing and installing ⇒ Rep. gr. 20



Fitting location of brake light switch - F-

- ◆ In footwell on brake pedal

Removing and installing ⇒ Rep. gr. 45



Fitting location of fuel pump control unit - J538-

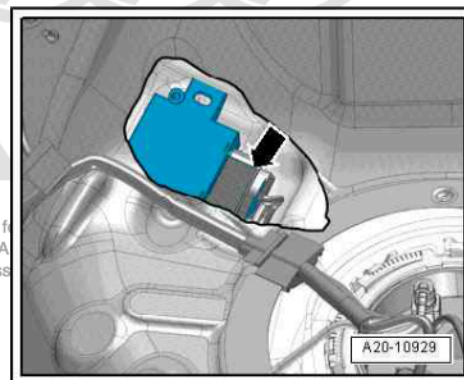
- ◆ Fuel pump control unit - J538- -arrow- is located between floor panel and fuel tank level with rear seat bench (right-side).



Note

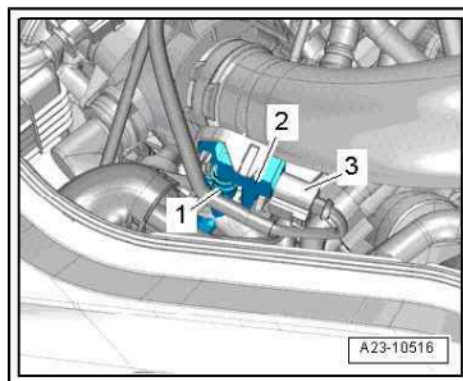
For illustration purposes, the floor panel is cut open in the illustration.

Removing and installing ⇒ Rep. gr. 20



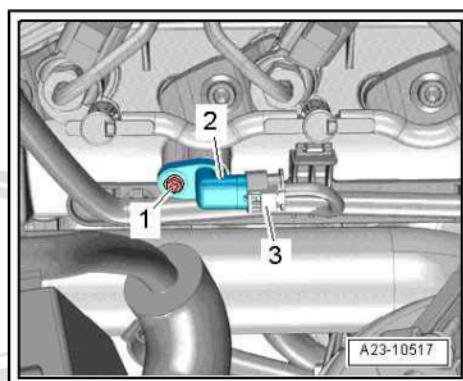
Fitting location of pressure differential sender - G505-

- ◆ -Item 2- at rear right of engine



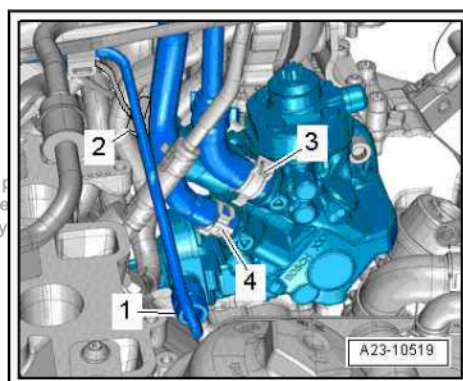
Fitting location of Hall sender - G40-

- ◆ -Item 2- on cylinder head cover, cylinder bank 1 (right-side)



Fitting location of fuel metering valve - N290-

- ◆ -Item 2- in high-pressure pump

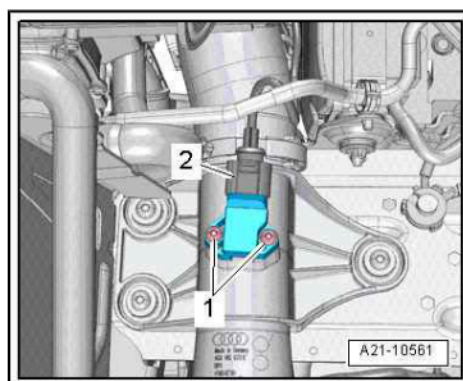


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Fitting location of charge pressure sender - G31- / intake air temperature sender - G42-

- ◆ -Item 2- at air pipe (left-side) in engine compartment

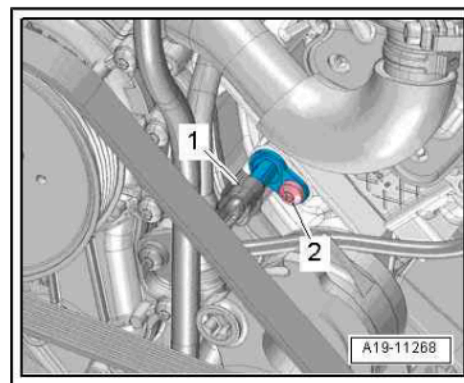
Removing and installing ⇒ Rep. gr. 21



Fitting location of temperature sender for engine temperature regulation - G694-

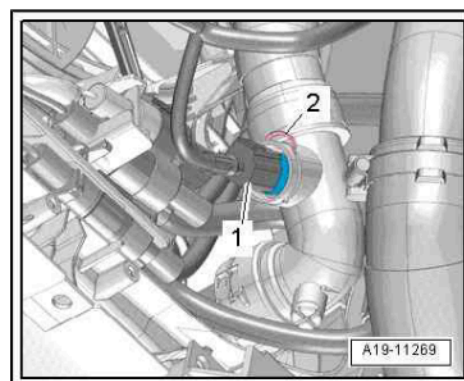
◆ -Item 1- at front left of cylinder block

Removing and installing ⇒ Rep. gr. 19

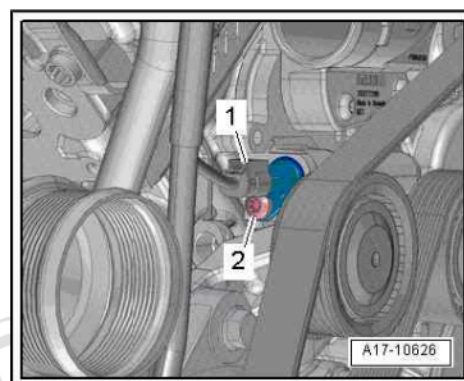


Fitting location of radiator outlet coolant temperature sender - G83-

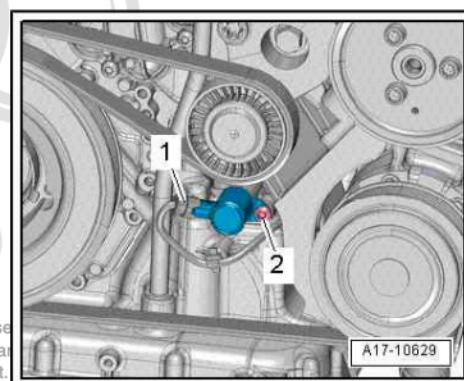
Removing and installing ⇒ Rep. gr. 19



Oil temperature sender 2 - G664-



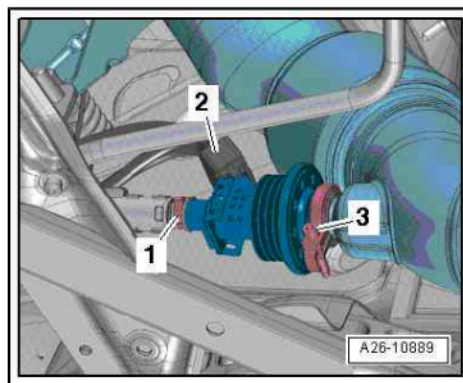
Valve for oil pressure control - N428-



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Injector for reducing agent - N474- (engine codes CKVB and CPNB only)

Removing and installing ⇒ Rep. gr. 26



Components at bottom of tank (engine code CKVB only)

1 - Control unit for reducing agent metering system - J880-

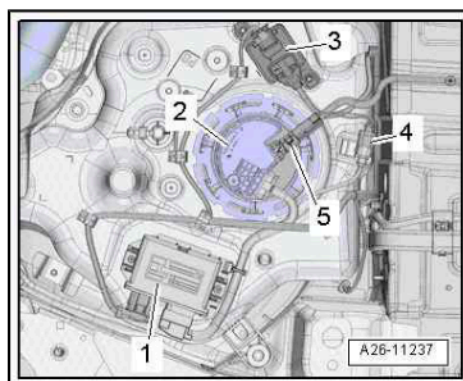
2 - Reservoir

3 - Control unit for NOx sender 2 - J881- and NOx sender 2 - G687-

4 - Electrical connector for heater for reducing agent line - Z104-

5 - Reducing agent line

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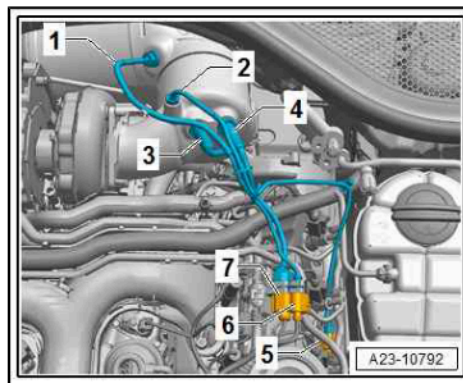
The following components are located in the reservoir -item 2-:

- ◆ Tank sender for reducing agent - G684-
- ◆ Temperature sender for reducing agent - G685-
- ◆ Pressure sender for reducing agent metering system - G686-
- ◆ Pump for reducing agent - V437-
- ◆ Heater for reducing agent tank - Z102-

Removing and installing ⇒ Rep. gr. 26

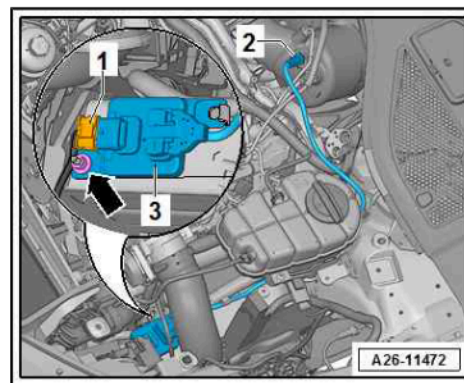
Fitting locations of exhaust gas temperature sensors (engine code CPNB only)

- 1 - Exhaust gas temperature sender 3 - G495-
- 2 - Exhaust gas temperature sender 2 - G448-
- 3 - NOx sender - G295-
- 4 - Lambda probe - G39-
- 5 - Electrical connector for exhaust gas temperature sender 2 - G448-
- 6 - Electrical connector for exhaust gas temperature sender 3 - G495-
- 7 - Electrical connector for Lambda probe - G39-



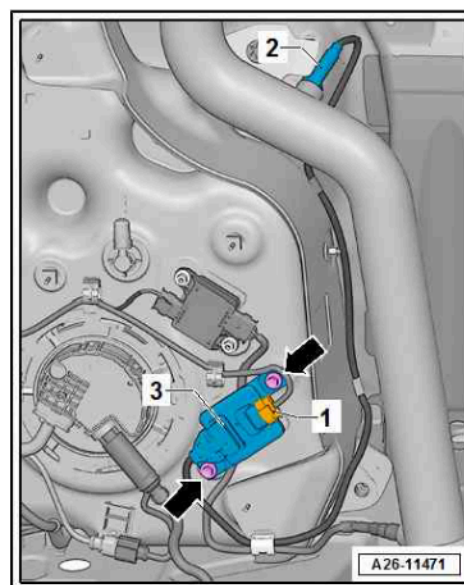
Control unit for NOx sender - J583- with NOx sender - G295- (engine code CPNB only)

- 1 - Electrical connector for control unit for NOx sender - J583-
- 2 - NOx sender - G295-
- 3 - Control unit for NOx sender - J583-



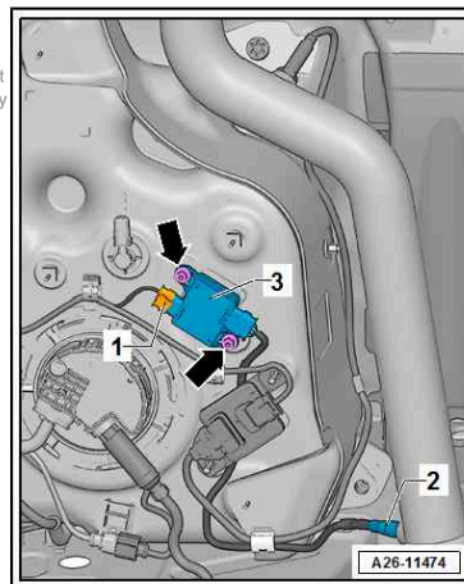
Control unit for NOx sender 2 - J881- and NOx sender 2 - G687- (engine code CPNB only)

- 1 - Electrical connector for control unit for NOx sender 2 - J881-
- 2 - NOx sender 2 - G687-
- 3 - Control unit for NOx sender 2 - J881-



Particulate sensor - G784- (engine code CPNB only)

- 1 - Electrical connector for particulate sensor - G784-
- 2 - Particulate sensor - G784-
- 3 - Control unit for particulate sensor - G784-



2.2 Overview of fitting locations - injection system (CGQB)

Engine compartment

1 - Air mass meter - G70-

- ☐ Removing and installing
⇒ [page 80](#)

2 - Hall sender - G40-

- ☐ Fitting location
⇒ [page 22](#)
- ☐ Exploded view
⇒ [page 100](#)

3 - Electrical connector for exhaust gas recirculation temperature sensor - G98-

- ☐ Fitting location
⇒ [page 22](#)
- ☐ Removing and installing
⇒ Rep. gr. 26

4 - Electrical connector

- ☐ For map-controlled engine cooling system thermostat - F265- , fuel metering valve - N290- and exhaust gas recirculation control motor - V338-
- ☐ Fitting location
⇒ [page 22](#)

5 - Restrictor

- ☐ In fuel return line
- ☐ Fitting location
⇒ [page 22](#)

6 - Pressure differential sender - G505-

- ☐ For electrical connector for exhaust gas temperature sender 3 - G495-
- ☐ Fitting location ⇒ [page 24](#)

7 - Fuel temperature sender - G81-
8 - Control unit for structure-borne sound - J869-
9 - Control unit for turbocharger 1 - J724-

- ☐ Exhaust gas temperature sender 1 - G235-
- ☐ Charge pressure sender 2 - G447-
- ☐ Fitting location ⇒ [page 25](#)
- ☐ Removing and installing ⇒ Rep. gr. 21

10 - Exhaust gas recirculation control motor - V338-

- ☐ Removing and installing ⇒ Rep. gr. 26

11 - Regulating flap potentiometer - G584-

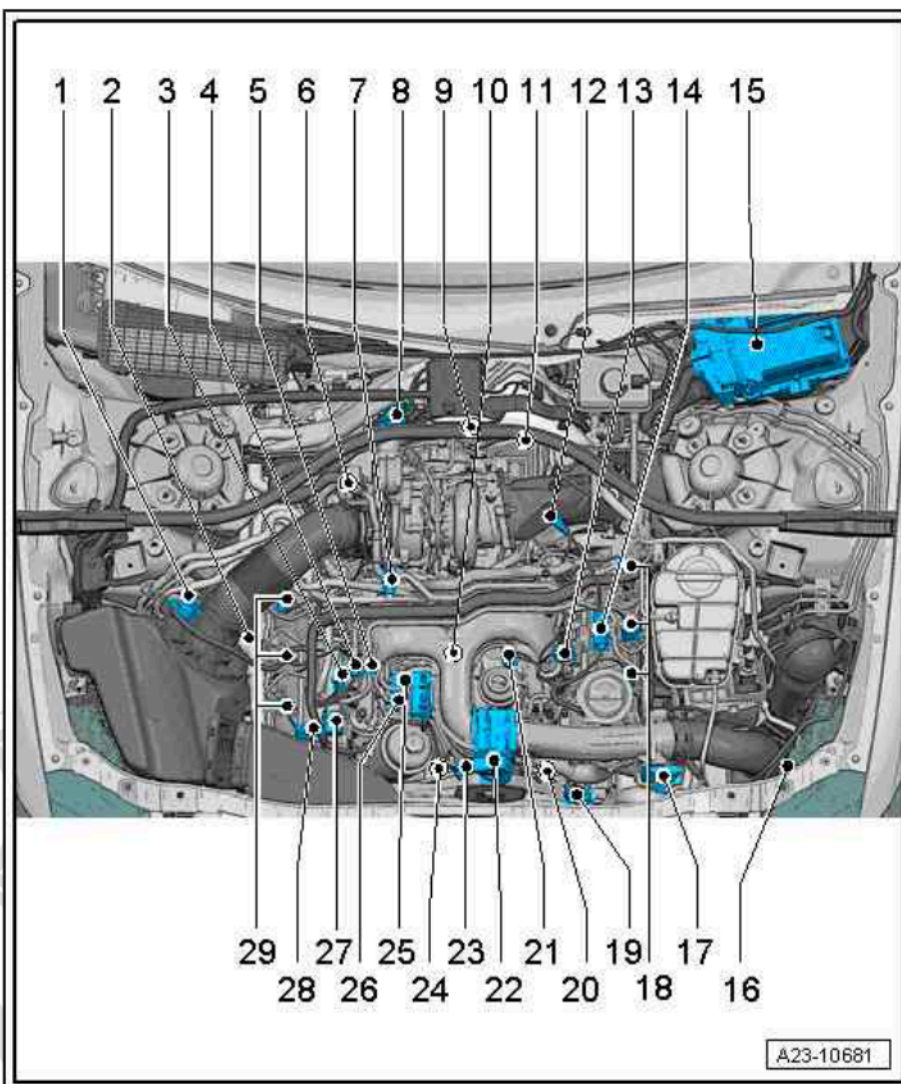
- ☐ Fitting location ⇒ [page 23](#)

12 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Fitting location ⇒ [page 24](#)
- ☐ Exploded view ⇒ [page 90](#)

13 - Fuel pressure sender - G247-

- ☐ Removing and installing ⇒ [page 85](#)
- ☐ Tightening torque ⇒ [page 55](#)



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- 14 - Electrical connector for Lambda probe - G39-
- 15 - Engine control unit - J623-
 - ☐ Fitting location ⇒ [page 11](#)
 - ☐ Removing and installing ⇒ [page 98](#)
- 16 - Charge pressure sender - G31- / intake air temperature sender - G42-
 - ☐ Fitting location ⇒ [page 22](#)
- 17 - Throttle valve module - J338-
 - ☐ Exploded view ⇒ [page 35](#)
- 18 - Injectors
 - ☐ Cylinder bank 2
 - ☐ Removing and installing ⇒ [page 67](#)
- 19 - Turbine changeover valve - N529-
 - ☐ Checking ⇒ Rep. gr. 21
- 20 - Temperature sender for engine temperature regulation - G694-
 - ☐ Fitting location ⇒ [page 23](#)
- 21 - Exhaust gas recirculation temperature sensor - G98-
 - ☐ Removing and installing ⇒ Rep. gr. 26
- 22 - Intake manifold flap motor - V157-
 - ☐ Exploded view ⇒ [page 35](#)
- 23 - Exhaust gas recirculation cooler change-over valve - N345-
- 24 - Map-controlled engine cooling system thermostat - F265-
 - ☐ Fitting location ⇒ [page 22](#)
 - ☐ Removing and installing ⇒ Rep. gr. 19
- 25 - Coolant valve for cylinder head - N489-
- 26 - Charge pressure control solenoid valve - N75-
- 27 - Oil pressure switch for reduced oil pressure - F378-
 - ☐ Removing and installing ⇒ Rep. gr. 17
- 28 - Fuel pressure regulating valve - N276-
 - ☐ Exploded view ⇒ [page 44](#)
- 29 - Injectors
 - ☐ Cylinder bank 1
 - ☐ Removing and installing ⇒ [page 67](#)

Engine (top view)

1 - Fuel pressure regulating valve - N276-

- ☐ Exploded view
⇒ [page 44](#)

2 - Injector, cylinder 1 - N30-

- ☐ Exploded view
⇒ [page 44](#)

3 - Glow plug 1 - Q10-

- ☐ Exploded view
⇒ [page 100](#)

4 - Injector, cylinder 2 - N31-

- ☐ Exploded view
⇒ [page 44](#)

5 - Hall sender - G40-

- ☐ Fitting location
⇒ [page 22](#)
- ☐ Exploded view
⇒ [page 100](#)

6 - Glow plug 2 - Q11-

- ☐ Exploded view
⇒ [page 100](#)

7 - Injector, cylinder 3 - N32-

- ☐ Exploded view
⇒ [page 44](#)

8 - Glow plug 3 - Q12-

- ☐ Exploded view
⇒ [page 100](#)

9 - Fuel temperature sender - G81-

10 - Exhaust gas temperature sender 1 - G235-

- ☐ Fitting location ⇒ [page 25](#)
- ☐ Removing and installing ⇒ Rep. gr. 26

11 - Fuel metering valve - N290-

- ☐ Fitting location ⇒ [page 22](#)

12 - Charge pressure sender 2 - G447-

- ☐ Fitting location ⇒ [page 25](#)

13 - Control unit for turbocharger 1 - J724-

- ☐ On turbocharger
- ☐ Removing and installing ⇒ Rep. gr. 21

14 - Exhaust gas recirculation control motor - V338-

- ☐ Removing and installing ⇒ Rep. gr. 26

15 - Glow plug 6 - Q15-

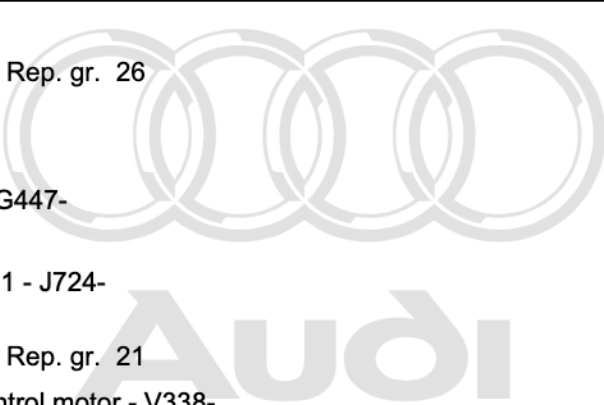
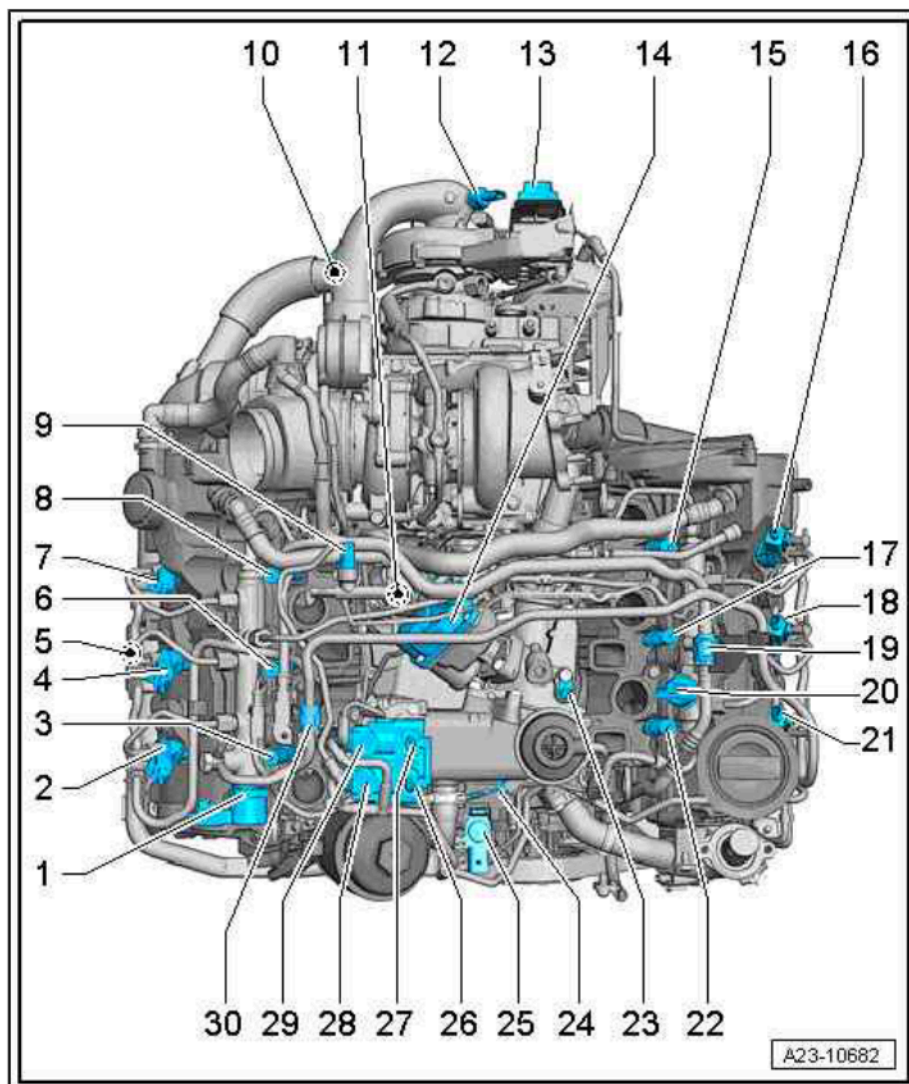
- ☐ Exploded view ⇒ [page 100](#)

16 - Injector, cylinder 6 - N84-

- ☐ Exploded view ⇒ [page 44](#)

17 - Glow plug 5 - Q14-

- ☐ Exploded view ⇒ [page 100](#)



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18 - Injector, cylinder 5 - N83-

- ❑ Exploded view ⇒ [page 44](#)

19 - Electrical connector for Lambda probe - G39-

20 - Fuel pressure sender - G247-

- ❑ Fitting location ⇒ [page 24](#)
- ❑ Removing and installing ⇒ [page 85](#)

21 - Injector, cylinder 4 - N33-

- ❑ Exploded view ⇒ [page 44](#)

22 - Glow plug 4 - Q13-

- ❑ Exploded view ⇒ [page 100](#)

23 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ Rep. gr. 19

24 - Exhaust gas recirculation temperature sensor - G98-

- ❑ Removing and installing ⇒ Rep. gr. 26

25 - Exhaust gas recirculation cooler change-over valve - N345-

26 - Electrical connector for charge pressure control solenoid valve - N75-
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27 - Electrical connector coolant valve for cylinder head - N489-

28 - Charge pressure control solenoid valve - N75-

29 - Coolant valve for cylinder head - N489-

30 - Restrictor in fuel return line

- ❑ Checking ⇒ [page 66](#)

Engine (front view)

1 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
⇒ Rep. gr. 17

2 - Map-controlled engine cooling system thermostat - F265-

- ☐ Removing and installing
⇒ Rep. gr. 19

3 - Oil temperature sender 2 - G664-

- ☐ Fitting location
⇒ [page 23](#)
- ☐ Removing and installing
⇒ Rep. gr. 17

4 - Oil pressure switch - F22-

- ☐ Removing and installing
⇒ Rep. gr. 17

5 - Oil pressure switch for reduced oil pressure - F378-

- ☐ Removing and installing
⇒ Rep. gr. 17

6 - Exhaust gas recirculation cooler change-over valve - N345-

- ☐ Removing and installing
⇒ Rep. gr. 26

7 - Intake manifold flap motor - V157-

- ☐ Exploded view
⇒ [page 35](#)

8 - Throttle valve module - J338-

- ☐ Exploded view
⇒ [page 35](#)

9 - Turbine changeover valve - N529-

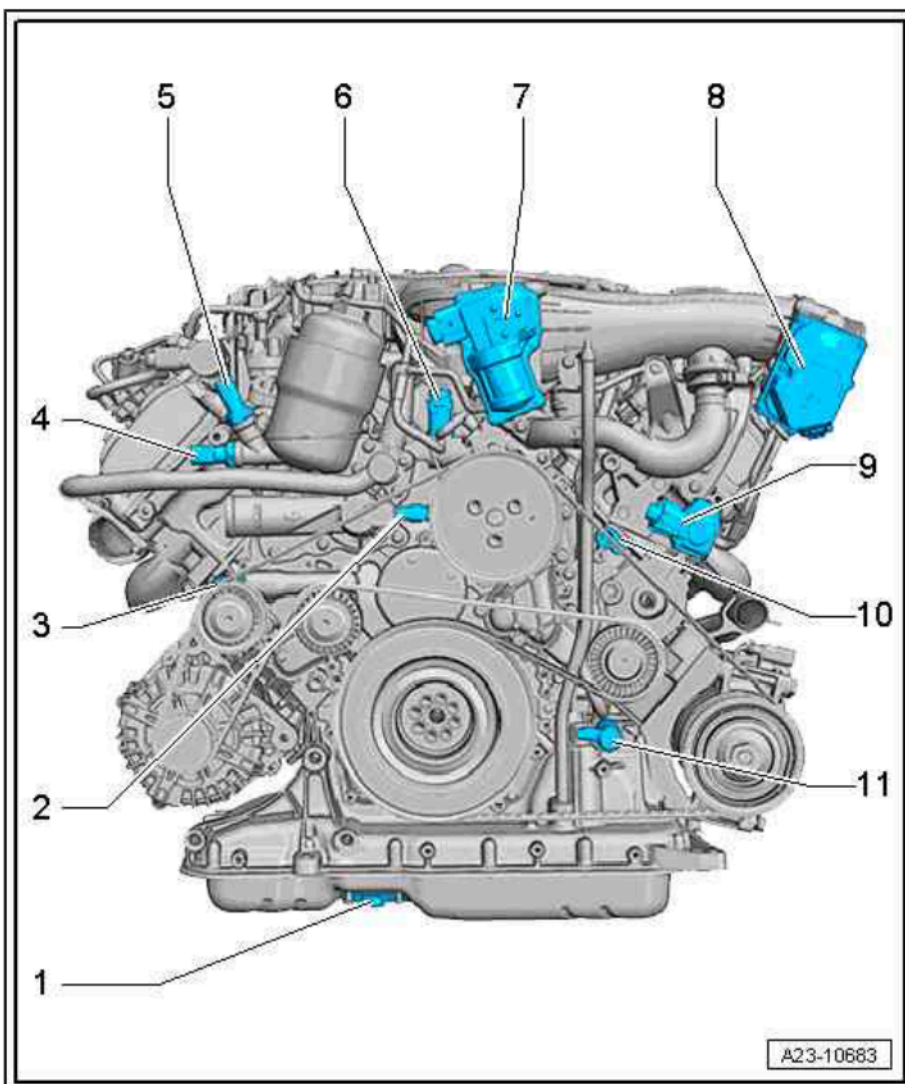
- ☐ Checking ⇒ Rep. gr. 21

10 - Temperature sender for engine temperature regulation - G694-

- ☐ Fitting location ⇒ [page 23](#)

11 - Valve for oil pressure control - N428-

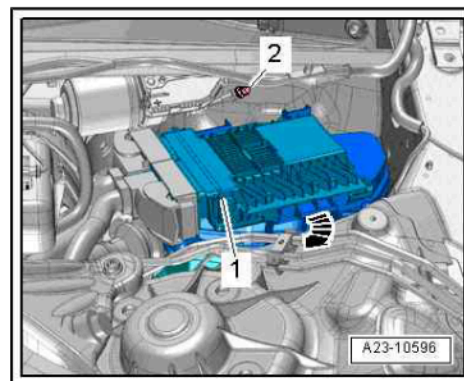
- ☐ Fitting location ⇒ [page 24](#)
- ☐ Removing and installing ⇒ Rep. gr. 17



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Fitting location of engine control unit - J623-

- ◆ -Item 1- in plenum chamber (left-side)



Fitting location of accelerator position sender - G79- / accelerator position sender 2 - G185-

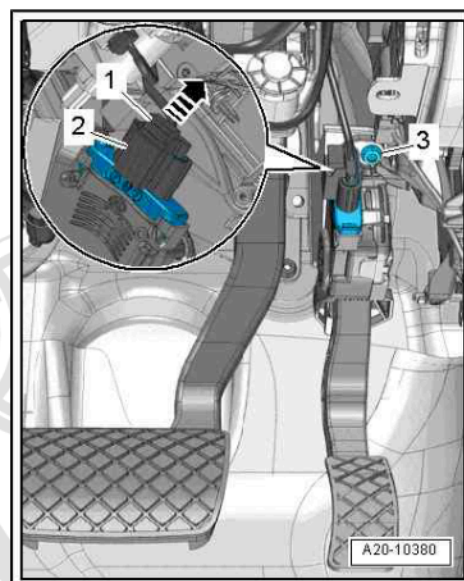
- ◆ In accelerator pedal module



Note

The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

Removing and installing ⇒ Rep. gr. 20

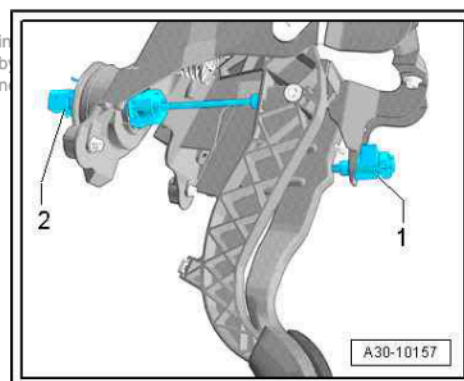


Fitting locations (driver's side)

- 1 - Brake light switch - F- and brake pedal switch - F47-
- 2 - Clutch position sender - G476- with clutch pedal switch for engine start - F194- and clutch pedal switch - F36- (manual gearbox only)

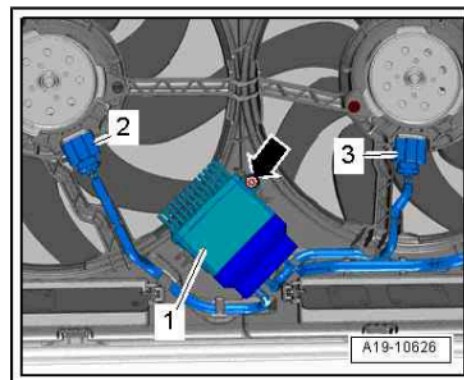
Removing and installing ⇒ Rep. gr. 45

Removing and installing ⇒ Rep. gr. 20



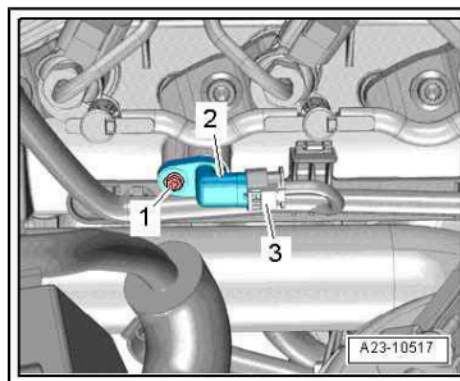
Radiator fan control unit - J293-

- 1 - Radiator fan control unit - J293-
- 2 - Electrical connector for radiator fan - V7-
- 3 - Electrical connector for radiator fan 2 - V177-



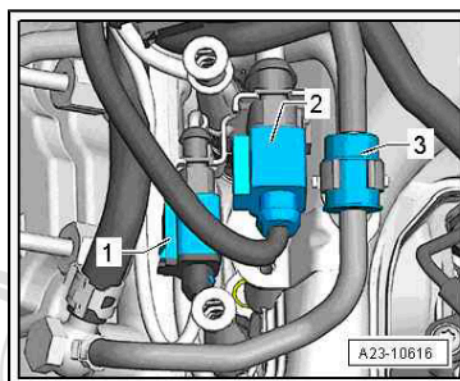
Fitting location of Hall sender - G40-

- ◆ -Item 2- on cylinder head cover, cylinder bank 1 (right-side)



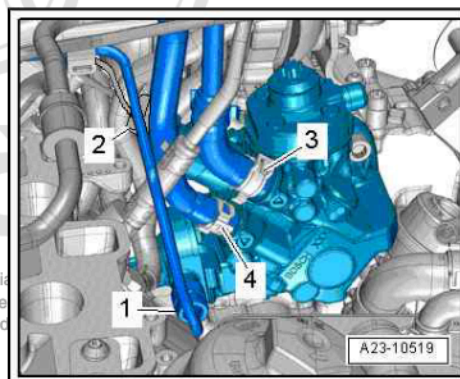
Electrical connectors

- 1 - For exhaust gas recirculation temperature sensor - G98-
- 2 - For map-controlled engine cooling system thermostat - F265- , fuel metering valve - N290- and exhaust gas recirculation control motor - V338-
- 3 - Restrictor in fuel return line



Fitting location of fuel metering valve - N290-

- ◆ -Item 2- in high-pressure pump

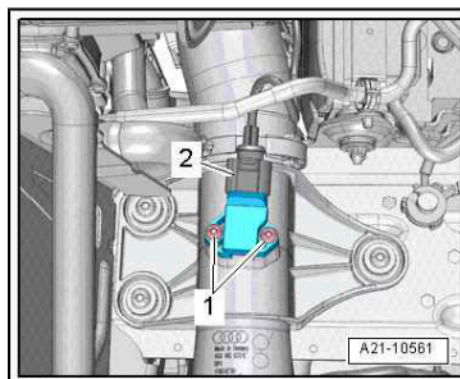


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Fitting location of charge pressure sender - G31- / intake air temperature sender - G42-

- ◆ -Item 2- at air pipe (left-side) in engine compartment

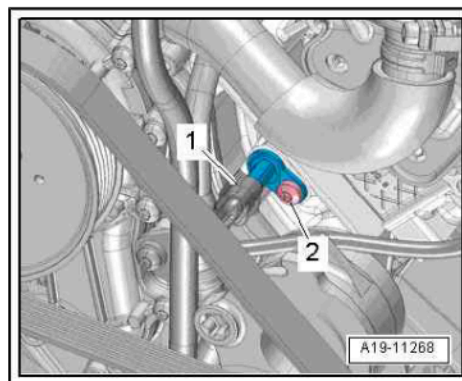
Removing and installing ⇒ Rep. gr. 21



Fitting location of temperature sender for engine temperature regulation - G694-

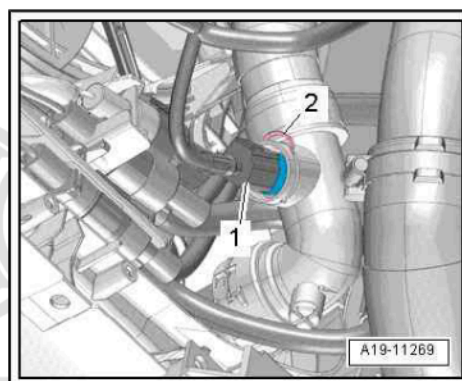
◆ -Item 1- at front left of cylinder block

Removing and installing ⇒ Rep. gr. 19



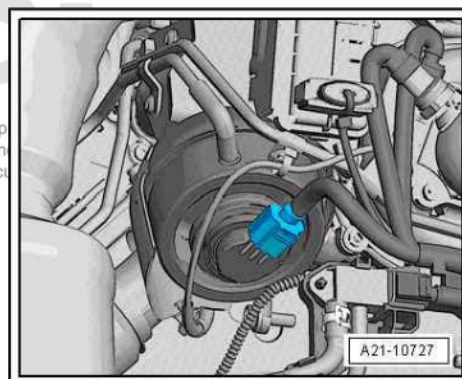
Fitting location of radiator outlet coolant temperature sender - G83-

Removing and installing ⇒ Rep. gr. 19

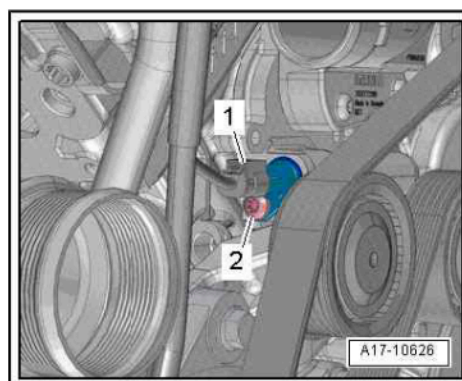


Regulating flap potentiometer - G584-

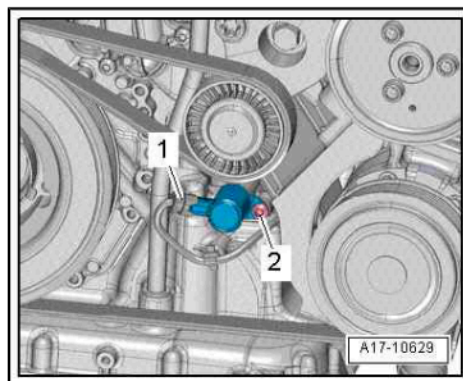
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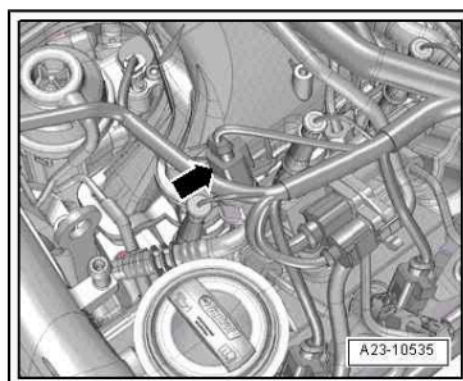
Oil temperature sender 2 - G664-



Valve for oil pressure control - N428-



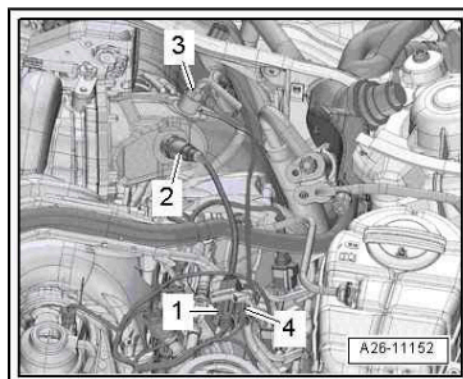
Fuel pressure sender - G247- -arrow-



Lambda probe - G39-

2 - Lambda probe - G39-

4 - Electrical connector for Lambda probe - G39-



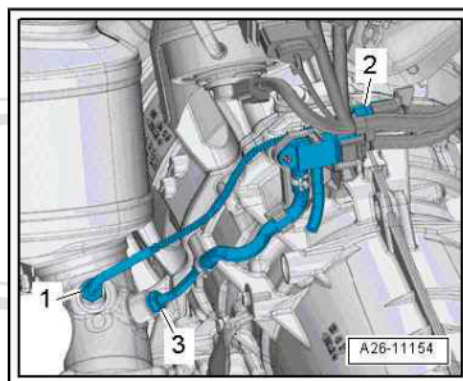
Fitting location of pressure differential sender - G505-

1 - Exhaust gas temperature sender 3 - G495-

2 - Pressure differential sender - G505-

3 - Connection from pressure pipe for pressure differential sender - G505-

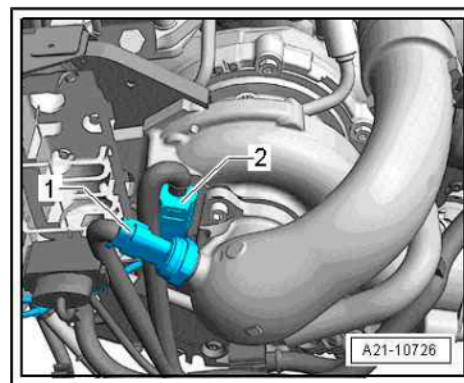
◆ -Item 2- at rear right of engine



Fitting locations on turbocharger

- 1 - Charge pressure sender 2 - G447-
- 2 - Exhaust gas temperature sender 1 - G235-

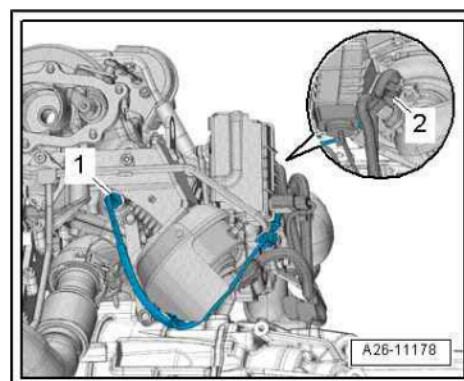
The turbocharger 1 control unit - J724- can be seen on the left.



Exhaust gas temperature sender in turbocharger

- 1 - Exhaust gas temperature sender 1 - G235-
- 2 - Electrical connector for exhaust gas temperature sender 1 - G235-

Removing and installing ⇒ Rep. gr. 26



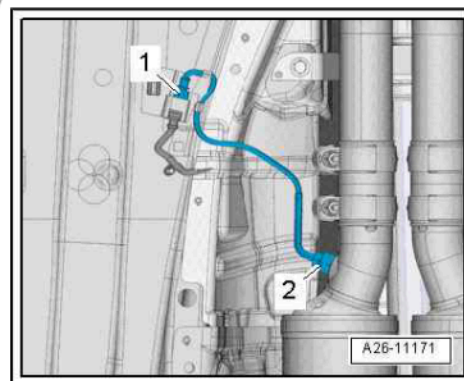
Exhaust gas temperature sender

- 1 - Electrical connector for bank 2 exhaust gas temperature sender 4 - G649-
- 2 - Exhaust gas temperature sender 4 for cylinder bank 2 - G649-



Note

- ◆ The removal of the exhaust gas temperature sender 4 for bank 2 - G649- is shown as an example.
- ◆ Exhaust gas temperature sender 4 - G648- is fitted on the opposite side.

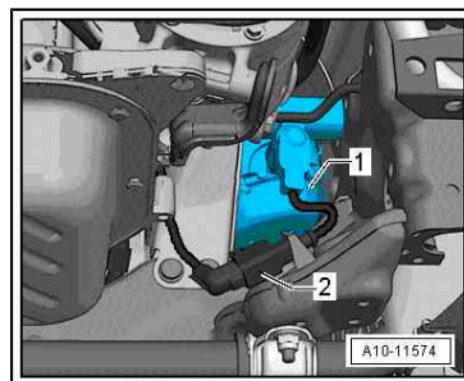


Removing and installing ⇒ Rep. gr. 26

Engine mounting (left-side)

- 1 - Left electrohydraulic engine mounting solenoid valve - N144-
- 2 - Electrical connector for left electrohydraulic engine mounting solenoid valve - N144-

Removing and installing ⇒ Rep. gr. 10

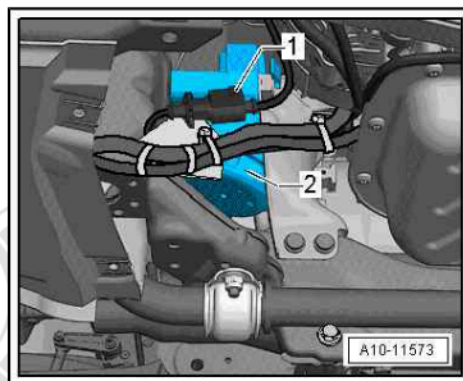


Engine mounting (right-side)

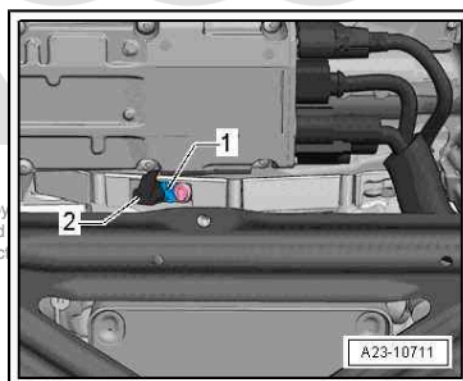
1 - Electrical connector for right electrohydraulic engine mounting solenoid valve - N145-

2 - Right electrohydraulic engine mounting solenoid valve - N145-

Removing and installing ⇒ Rep. gr. 10



Engine speed sender - G28-



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2.3 Overview - fuel system



Caution

Risk of malfunctions caused by dirt.

The high-pressure fuel pump has very close tolerances and must not be allowed to run without fuel. To prevent this and to enable the engine to start quickly after parts have been renewed, it is important to observe the following:



Note

The high-pressure pump will be damaged if the first fuel filling operation is not performed.

1 - Fuel metering valve - N290-

- ☐ Do not unscrew

2 - High-pressure pump

- ☐ Exploded view
 ⇒ [page 44](#)

3 - Fuel rail

- ☐ For cylinder bank 1
 (right-side)

4 - Fuel pressure regulating valve - N276-

- ☐ Cannot be re-installed
- ☐ Removing and installing
 ⇒ [page 83](#)
- ☐ Tightening torque
 ⇒ [page 54](#)

5 - Fuel pressure sender - G247-

- ☐ Tightening torque
 ⇒ [page 55](#)
- ☐ Removing and installing
 ⇒ [page 85](#)

6 - Fuel rail

- ☐ For cylinder bank 2 (left-side)

7 - Injector

- ☐ Removing and installing
 ⇒ [page 67](#)

8 - Fuel return hoses

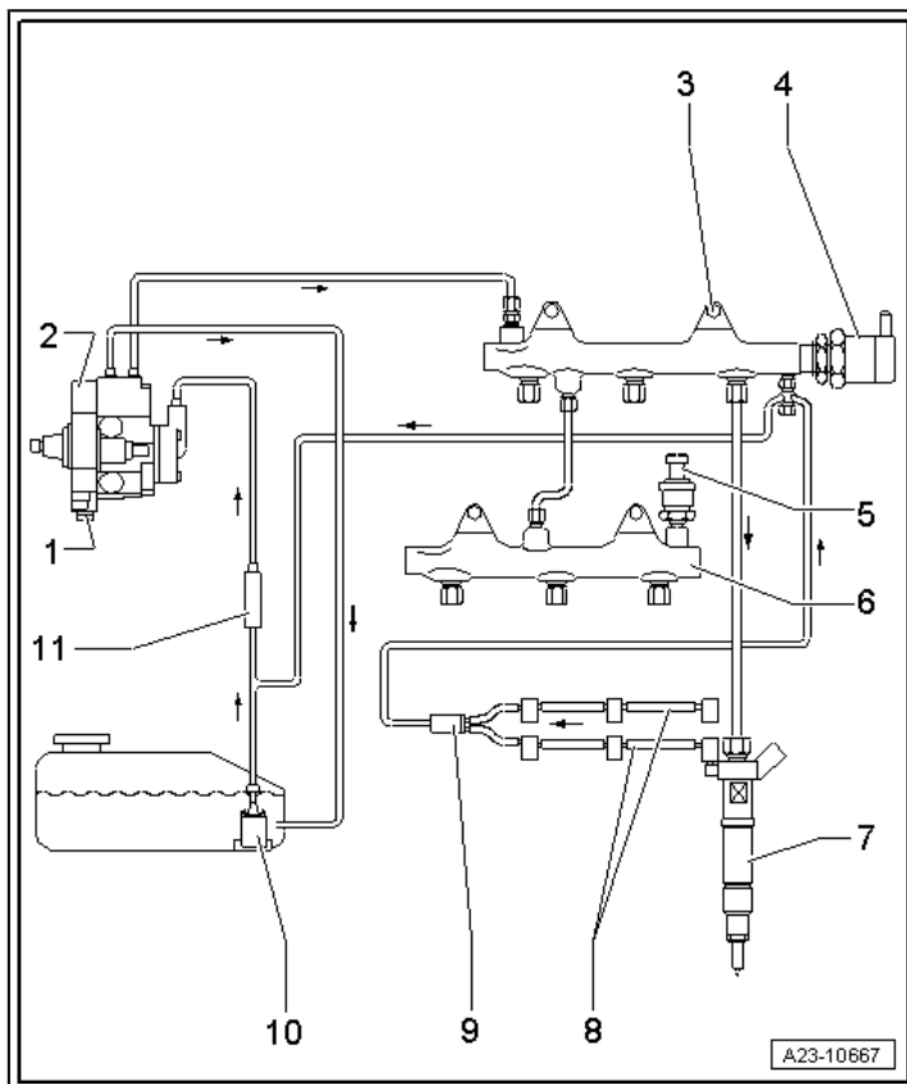
- ☐ Do not dismantle
- ☐ Renew together with re-
 strictor

9 - Restrictor

- ☐ Maintains a residual pressure in fuel return hoses
- ☐ Cannot be renewed separately; if defective, renew fuel return hoses

10 - Fuel system pressurisation pump - G6-

11 - Fuel filter



2.4 Filling and bleeding fuel system

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

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**Caution**

- ◆ If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled.
- ◆ If the high-pressure pump is removed or renewed, the fuel system must be bled before the engine is started for the first time. Procedure for first fuel filling
⇒ "5.3 Performing first fuel filling after installing high-pressure pump", page 50

Proceed as follows to fill fuel system with fuel:

- Connect a ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Select "Engine electronics" in vehicle self-diagnosis.
- Select "Guided Functions".
- Then select "Activate fuel pump".
- Select "120 seconds".
- The fuel pump starts running.
- The fuel pump must run for approx. 2 minutes to ensure that the fuel system is filled sufficiently with fuel.

**Note**

To repeat basic setting, switch ignition off and on once. Then start basic setting again.

- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Erase entry in event memory using ⇒ Vehicle diagnostic tester.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

**Note**

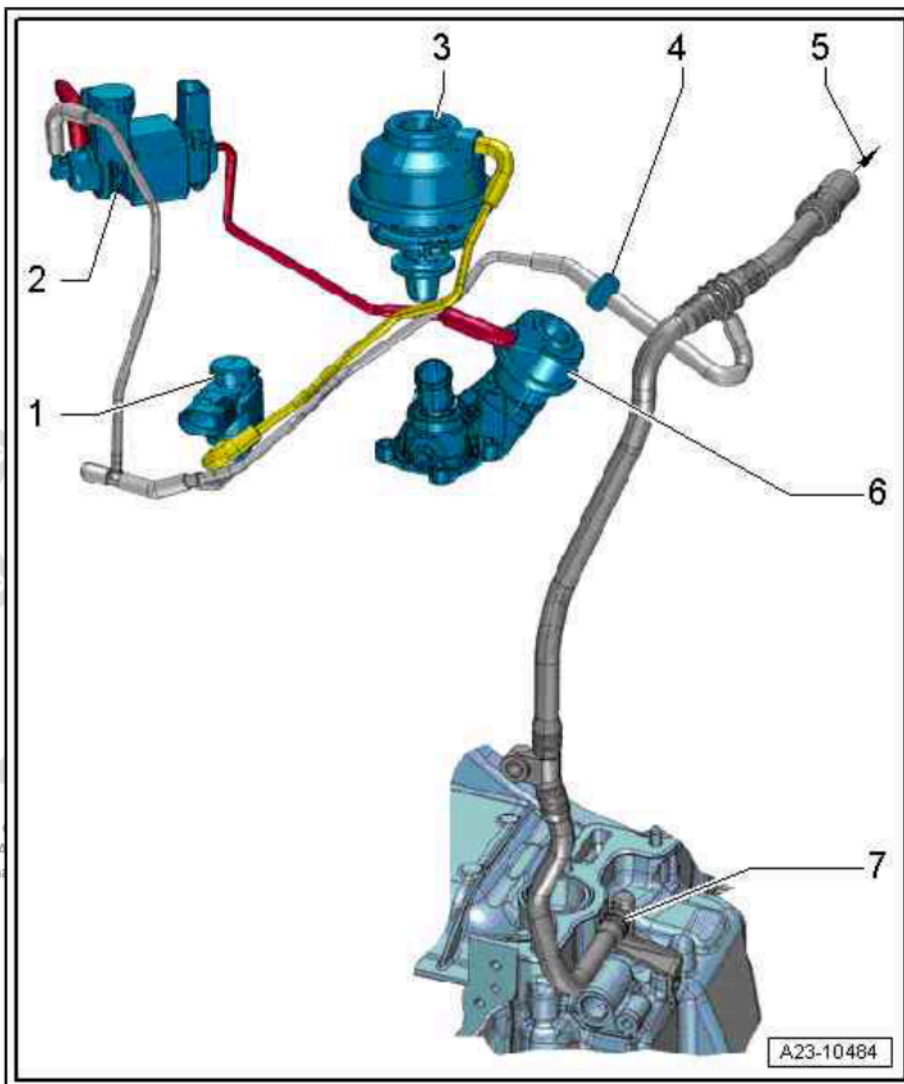
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- Interrogate event memory again.

2.5 Connection diagram - vacuum system

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- 1 - Exhaust gas recirculation cooler change-over valve - N345-
- 2 - Coolant valve for cylinder head - N489-
- 3 - Vacuum unit
 - ☐ For exhaust gas recirculation cooler
- 4 - Non-return valve
- 5 - To brake servo
- 6 - Shut-off valve
 - ☐ For coolant
- 7 - Vacuum connection
 - ☐ On sump (top section)
 - ☐ To vacuum pump



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3 Air cleaner

⇒ "3.1 Exploded view - air cleaner", page 30

⇒ "3.2 Removing and installing engine cover panel", page 31

⇒ "3.3 Removing and installing air filter element", page 31

⇒ "3.4 Removing and installing air cleaner housing", page 33

3.1 Exploded view - air cleaner

1 - Air duct

- ☐ Clean out salt deposits, dirt and leaves, etc.

2 - Sealing element

3 - Rubber grommet

- ☐ For air cleaner housing

4 - Air cleaner housing

- ☐ Clean out salt deposits, dirt and leaves, etc.
- ☐ Removing and installing
⇒ [page 33](#)

5 - Air filter element

- ☐ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing
⇒ [page 31](#)

6 - Cover

- ☐ For air cleaner housing
- ☐ Clean out salt deposits and dirt
- ☐ Removing and installing
⇒ [page 31](#)

7 - Housing

- ☐ For air mass meter - G70-

8 - Bolt

- ☐ 3.5 Nm

9 - Air mass meter - G70-

- ☐ With seal
- ☐ Removing and installing ⇒ [page 80](#)

10 - Air pipe

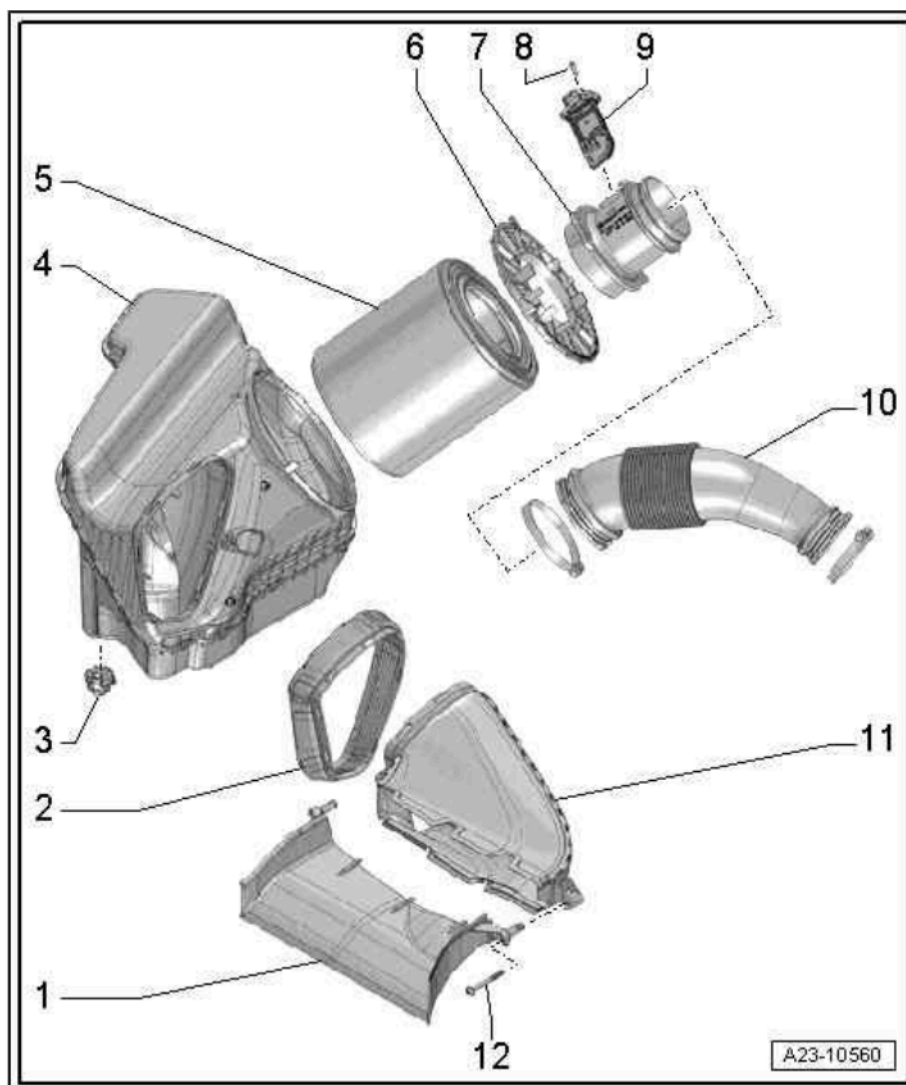
- ☐ Tightening torque for hose clips ⇒ Rep. gr. 21

11 - Air duct

- ☐ Clean out salt deposits, dirt and leaves, etc.

12 - Bolt

- ☐ 1.5 Nm



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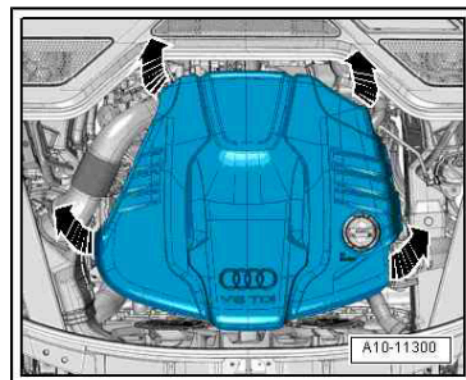
3.2 Removing and installing engine cover panel

Removing

- Carefully pull engine cover panel off retaining pins one after the other -arrows-. Do not jerk engine cover panel away, and do not try to pull on one side only.

Installing

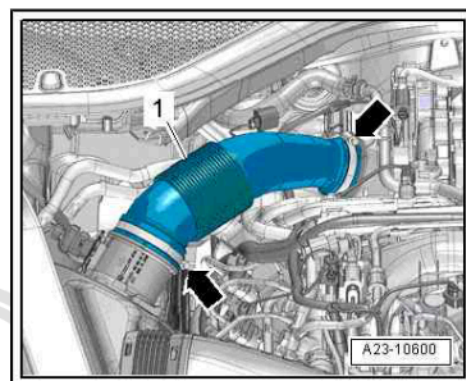
- To avoid damage, do not strike the engine cover panel with your fist or with any kind of tool.
- Observe oil filler neck when positioning engine cover panel.
- Press engine cover panel with both hands first onto retaining pins at rear and then onto retaining pins at front.



3.3 Removing and installing air filter element

Removing

- Release hose clips -arrows- and remove air pipe -1-.



- Release catch -1-, turn cover for air cleaner housing in anti-clockwise direction -arrow A- and detach.
- Take out air filter element.

Installing

Installation is carried out in the reverse order; note the following:

Tightening torques

- ◆ ⇒ ["3.1 Exploded view - air cleaner", page 30](#)

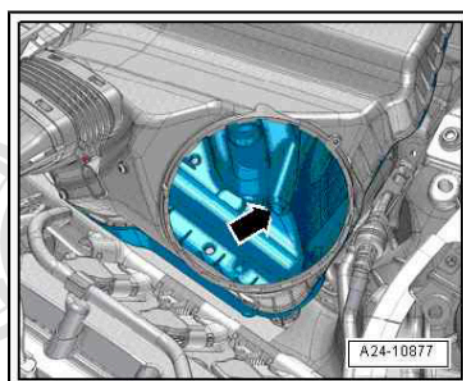
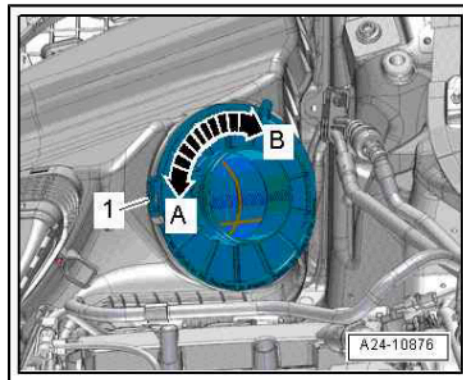
To ensure that the air mass meter -G70- functions properly, it is important to observe the following notes and instructions.



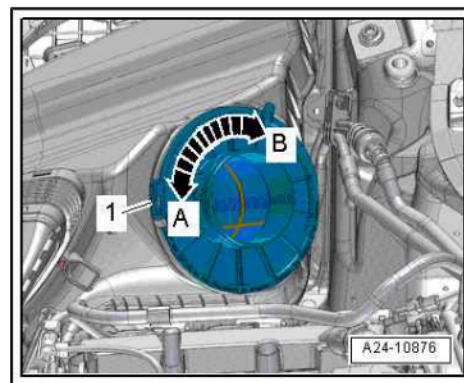
Note

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *The air cleaner housing MUST be clean.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Use a silicone-free lubricant when installing the air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To secure the air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*
- ◆ *Observe environmental requirements for disposal.*

- Clean salt residue, dirt and leaves out of air cleaner housing using a vacuum cleaner.
- Blow out water drain -arrow- on air cleaner housing with compressed air.
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.



- When installing air filter element, check that it is properly centred in retainer in air cleaner housing.
- Carefully fit cover on air cleaner housing without using force.
- Turn cover in clockwise direction -arrow B- until catch -1- engages.
- Make sure that air hose is securely fitted on air cleaner housing.



3.4 Removing and installing air cleaner housing

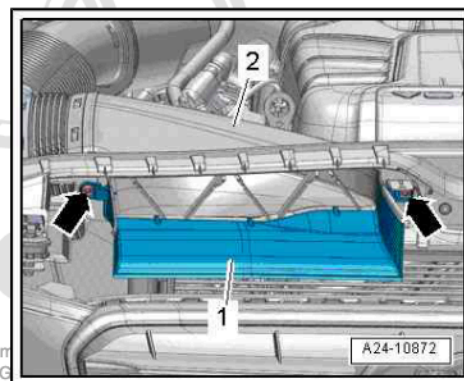
Removing

- Remove lock carrier cover ⇒ Rep. gr. 63 .
- Remove bolts -arrows- and detach air duct -2-.



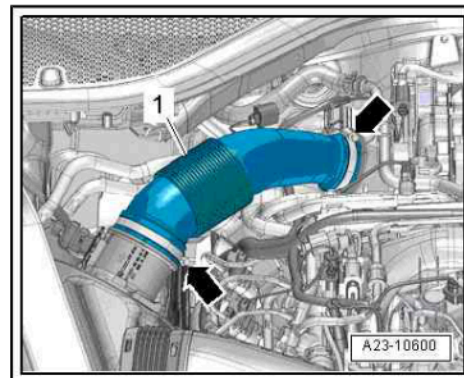
Note

Disregard -item 1-.



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- Release hose clips -arrows- and remove air pipe -1-.



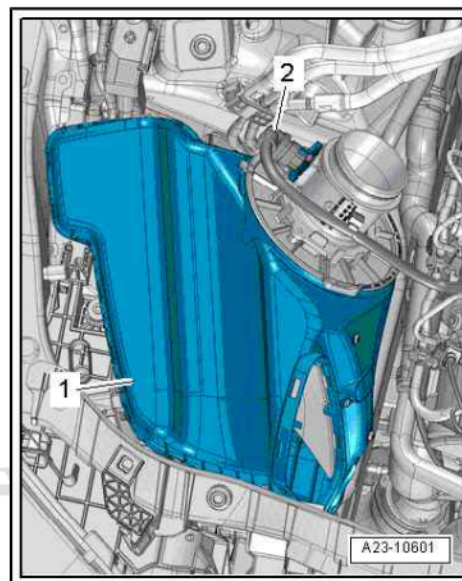
- Unplug electrical connector -2- at air mass meter - G70- and move clear.
- Lift off air cleaner housing -1-.

Installing



Note

- ◆ *The air cleaner housing MUST be clean.*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (air mass meter, air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Use a silicone-free lubricant when installing the air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*



Tightening torques

- ◆ ⇒ ["3.1 Exploded view - air cleaner", page 30](#)
- Check for salt residue, dirt and leaves in air pipe (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install lock carrier cover ⇒ Rep. gr. 63 .

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4 Intake manifold

⇒ "4.1 Exploded view - intake manifold", page 35

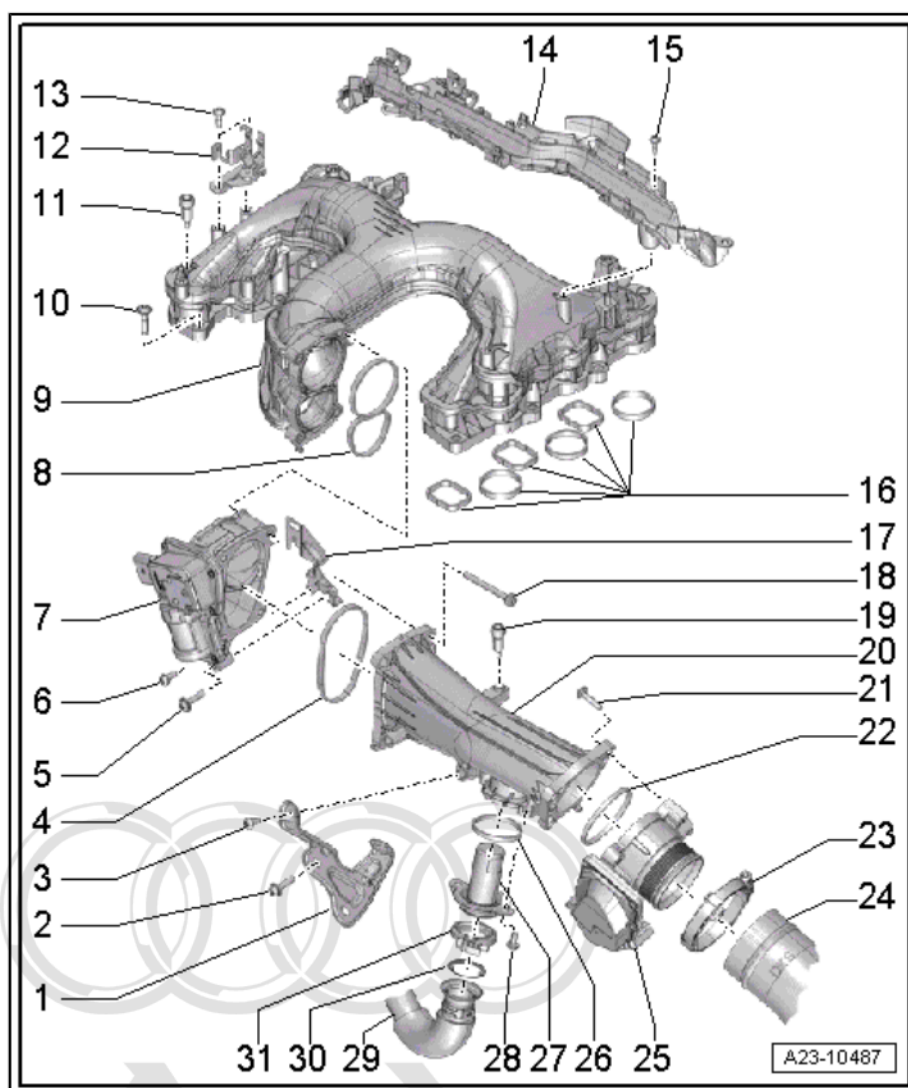
⇒ "4.2 Removing and installing intake manifold", page 36

⇒ "4.3 Removing and installing throttle valve module J338", page 41

⇒ "4.4 Removing and installing intake manifold flap motor V157", page 42

4.1 Exploded view - intake manifold

- 1 - Bracket
 - ☐ For air pipe
- 2 - Bolt
 - ☐ 9 Nm
- 3 - Bolt
 - ☐ 9 Nm
- 4 - Gasket
 - ☐ Renew
- 5 - Bolt
 - ☐ 9 Nm
- 6 - Bolt
 - ☐ 9 Nm
- 7 - Intake manifold flap motor - V157-
 - ☐ Removing and installing
 ⇒ [page 42](#)
- 8 - Gasket
 - ☐ Renew
- 9 - Intake manifold
 - ☐ Removing and installing
 ⇒ [page 36](#)
- 10 - Bolt
 - ☐ Tightening torque and
 sequence ⇒ [page 36](#)
- 11 - Mounting pin
 - ☐ For engine cover
 - ☐ 5 Nm
- 12 - Bracket
 - ☐ For electrical connector
- 13 - Bolt
 - ☐ 4 Nm
- 14 - Cable guide
- 15 - Bolt
 - ☐ 4 Nm
- 16 - Gaskets
 - ☐ Renew



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17 - Bracket

- ☐ For exhaust gas recirculation cooler change-over valve - N345-

18 - Bolt

- ☐ 9 Nm

19 - Mounting pin

- ☐ For engine cover
- ☐ 5 Nm

20 - Air pipe

21 - Bolt

- ☐ 9 Nm

22 - Seal

- ☐ Renew

23 - Screw-type clip

- ☐ Tightening torque ⇒ Rep. gr. 21

24 - Air hose

25 - Throttle valve module - J338-

- ☐ Removing and installing ⇒ [page 41](#)

26 - Seal

- ☐ Renew

27 - Pipe

- ☐ For exhaust gas recirculation

28 - Bolt

- ☐ 9 Nm

29 - Pipe

- ☐ For exhaust gas recirculation

30 - Seal

- ☐ Renew

31 - Screw-type clip

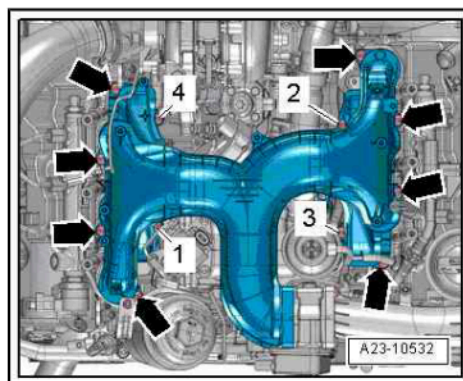
- ☐ Tightening torque ⇒ Rep. gr. 26

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Intake manifold - tightening torque and sequence

- Tighten bolts in 3 stages as follows:

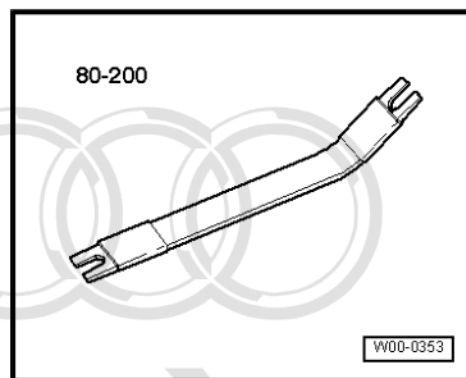
Stage	Bolts	Tightening torque
1.	-1 to 4-, -arrows-	Screw in by hand until contact is made
2.	-1 to 4-	5 Nm, in sequence indicated
3.	-1 to 4- -arrows-	9 Nm, in any sequence



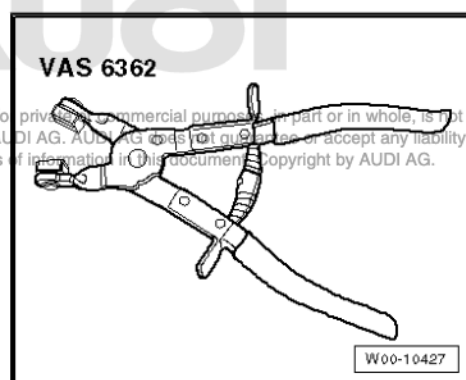
4.2 Removing and installing intake manifold

Special tools and workshop equipment required

◆ Removal lever - 80 - 200-



◆ Hose clip pliers - VAS 6362-



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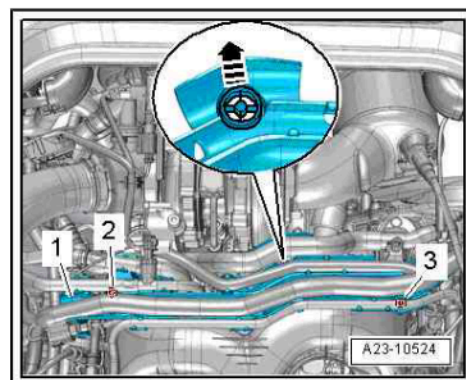
Removing



Caution

- ◆ Use an absorbent cloth to catch escaping fuel.
- ◆ No fuel must be allowed to spill onto components or seals in the vicinity of the engine; this can ultimately lead to damage caused by leaking seals.
- ◆ Risk of malfunctions caused by dirt.
- ◆ Observe
 ⇒ "1.3 Safety precautions when working on the fuel system", page 2.

- Pull off engine cover panel ⇒ [page 31](#).
- Use removal lever - 80 - 200- to move electrical wiring harness and hoses clear at cable guide -1-.
- Pull coolant hose off to rear -arrow-.
- Unscrew bolts -2 and 3- and remove cable guide -1-.

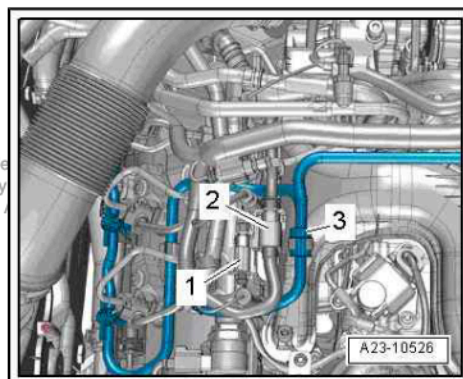
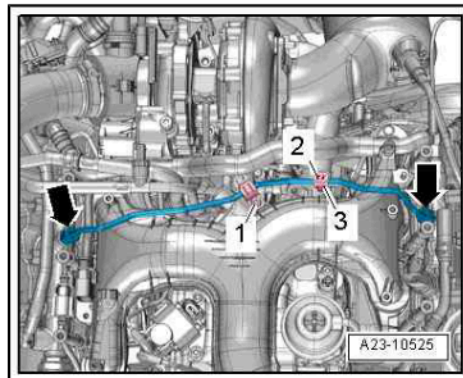


- Unscrew bolts -1 and 2- and detach retaining clamp -3-.
- Unscrew union nuts -arrows- and detach high-pressure pipe (top).



- Detach electrical connectors -1 and 2- and remove non-return valve -3- from bracket.

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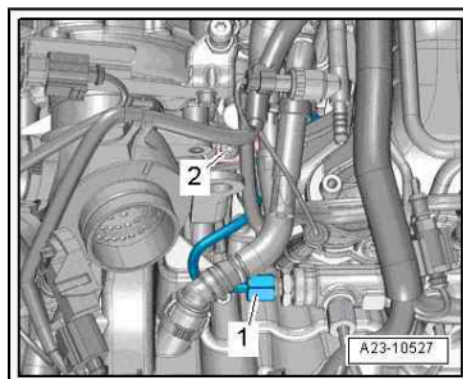


- If fitted, remove bolt -2- at retaining clamp for high-pressure pipe.



Note

Disregard -item 1-.

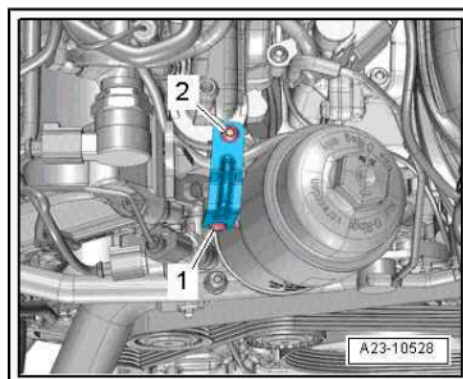


- Remove bolt -1- from bracket (right-side) for intake manifold.

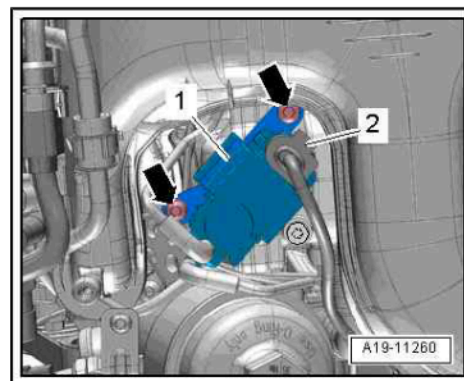


Note

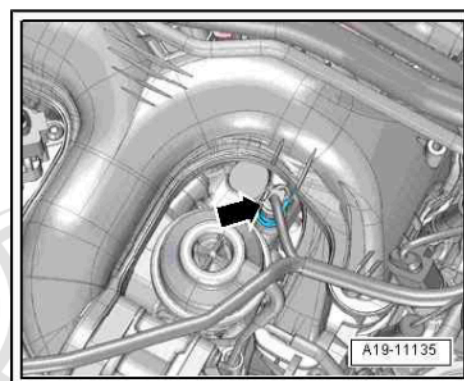
Disregard -item 2-.



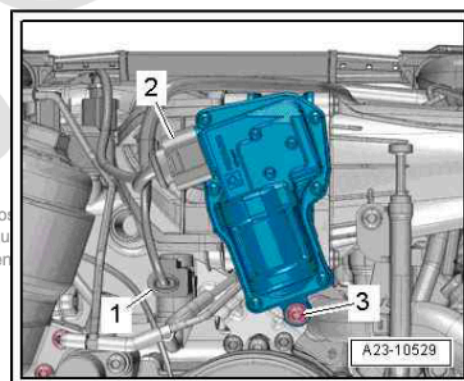
- Unplug electrical connector -2- at coolant valve for cylinder head - N489- -item 1-.
- Unscrew bolts -arrows- and place bracket with coolant valve for cylinder head - N489- to the side.



- Unplug electrical connector -arrow- at coolant temperature sender - G62- .



- Unplug electrical connectors -1 and 2- and move wiring harness clear to left side.
- Remove bolt -3- from bracket (centre) for intake manifold.

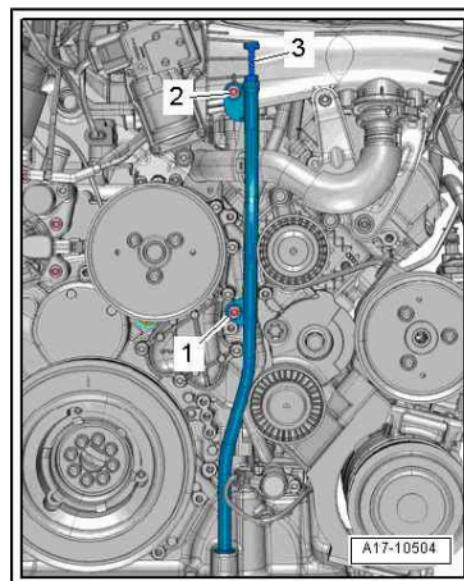


- Pull out plug -3-.
- Remove bolt -2- for dipstick guide tube.



Note

Disregard -item 1-.

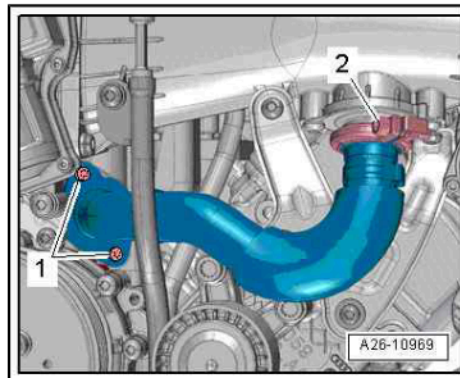


- Release screw-type clip -2- on exhaust gas recirculation pipe.



Note

Disregard -item 1-.

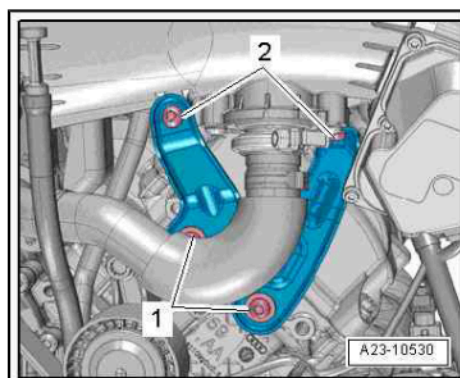


- Remove bolts -2- from bracket (left-side) for air pipe.



Note

Disregard -item 1-.

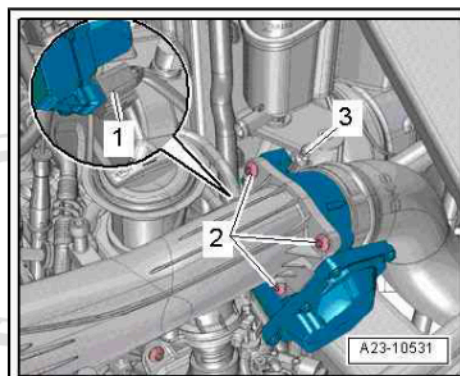


- Unplug electrical connector -1- at throttle valve module - J338- .
- Release screw-type clip -3- and detach air hose.



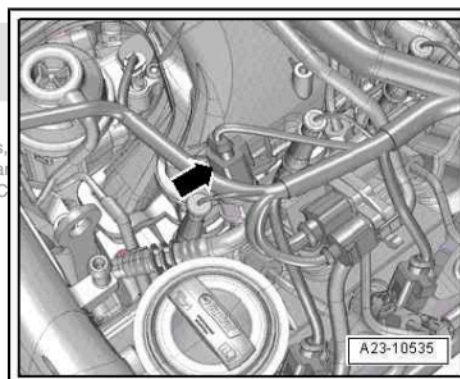
Note

Disregard -item 2-.



- Unplug electrical connectors on glow plugs.

- Remove fuel pressure sender - G247- -arrow- ➔ [page 85](#) .



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- Remove bolts -1 ... 4- and -arrows- and detach intake manifold.

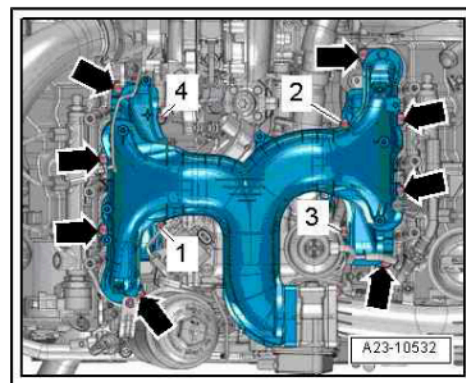
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To secure the air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*



Tightening torques

- ◆ ⇒ Fig. "Intake manifold - tightening torque and sequence", page 36
- Tighten bolts for intake manifold ⇒ page 36 .
- Install high-pressure pipe ⇒ page 77 .
- Install dipstick guide tube ⇒ Rep. gr. 17 .
- Install exhaust gas recirculation pipe ⇒ Rep. gr. 26 .

4.3 Removing and installing throttle valve module - J338-

Removing

- Pull off engine cover panel ⇒ page 31 .
- Release hose clip -3- and detach air hose.
- Unplug electrical connector -1-.
- Remove bolts -2- and detach throttle valve module - J338- .

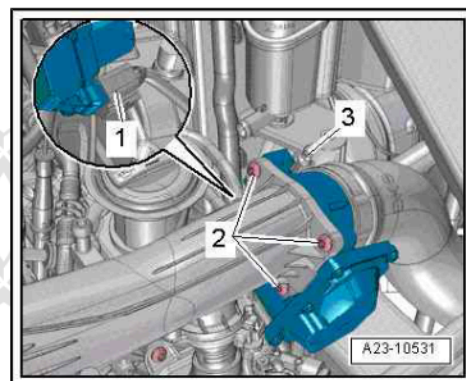
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Renew gasket.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To secure the air hoses at their connections, spray rust remover onto the worm thread of the used hose clips before installing.*



Tightening torques

- ◆ ⇒ "4.1 Exploded view - intake manifold", page 35

4.4 Removing and installing intake manifold flap motor - V157-

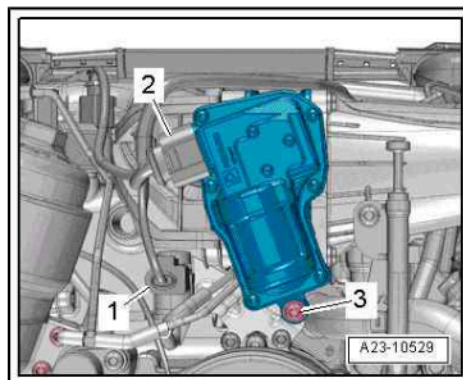
Removing

- Pull off engine cover panel ➔ [page 31](#) .
- Unplug electrical connector -2-.
- Remove bolt -3- from bracket (centre) for intake manifold.



Note

Disregard -item 1-.

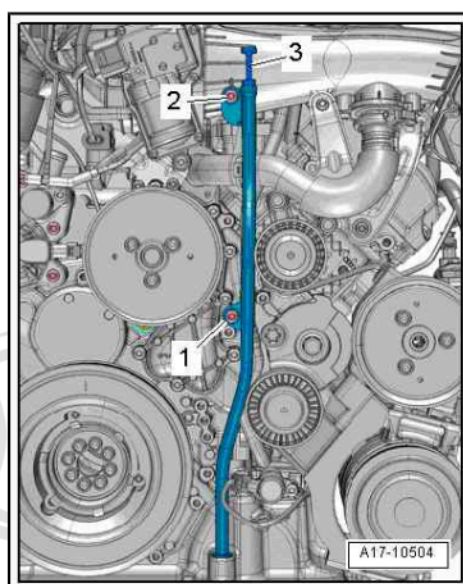


- Remove bolt -2- for dipstick guide tube.



Note

Disregard -items 1, 3-.

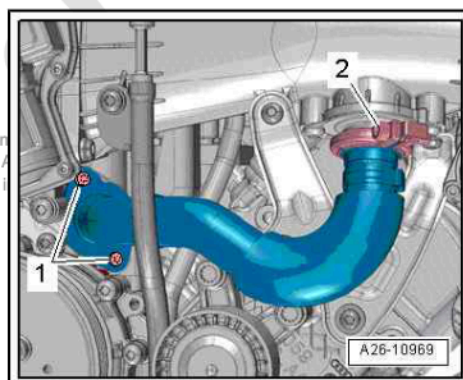


- Release screw-type clip -2- on exhaust gas recirculation pipe.



Note

Disregard -item 1-.



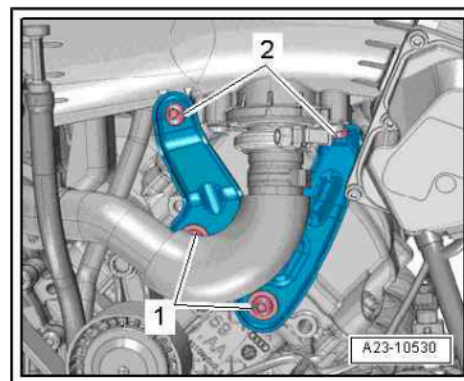
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- Remove bolts -2- from bracket (left-side) for air pipe.



Note

Disregard -item 1-.



- Remove bolts -arrows-.
- Press air pipe -2- to left side and detach intake manifold flap motor - V157- -item 1-.

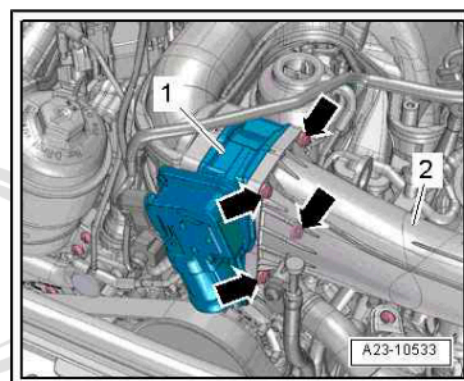
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*



Tightening torques

- ◆ ⇒ ["4.1 Exploded view - intake manifold", page 35](#)

- Install dipstick guide tube ⇒ Rep. gr. 17 .

- Install exhaust gas recirculation pipe ⇒ Rep. gr. 26 .

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5 High-pressure pump

⇒ "5.1 Exploded view - high-pressure pump", page 44

⇒ "5.2 Removing and installing high-pressure pump", page 45

⇒ "5.3 Performing first fuel filling after installing high-pressure pump", page 50

5.1 Exploded view - high-pressure pump

1 - Nut

- ☐ To loosen, counterhold adapter -item 2- using counterhold tool - T40248- or counterhold tool - T40292-
- ☐ 70 Nm

2 - Adapter

- ☐ For chain sprocket for high-pressure pump
- ☐ Different types of adapters are fitted depending on version
- ☐ To loosen nut -item 1-, use counterhold tool - T40248- or counterhold tool - T40292-
- ☐ Install on new high-pressure pump when renewing high-pressure pump

3 - O-ring

- ☐ Renew

4 - High-pressure pump



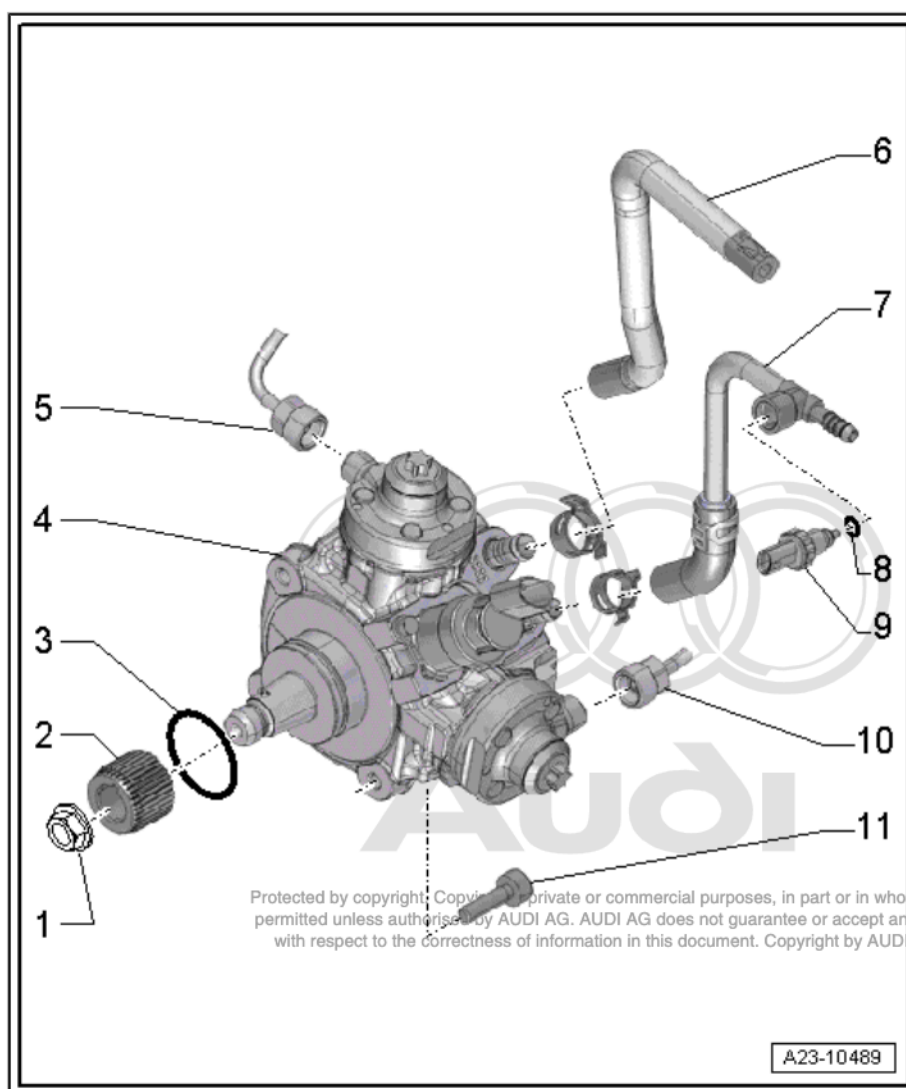
Caution

Risk of malfunctions caused by dirt.

Observe

⇒ "1.3 Safety precautions when working on the fuel system", page 2.

Running when dry causes irreparable damage to high-pressure pump. After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time ⇒ page 50.



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A23-10489

- ☐ Removing and installing ⇒ page 45

5 - High-pressure pipe

- ☐ Do not alter shape
- ☐ Check for damage before re-installing
- ☐ Always renew high-pressure pipe when renewing high-pressure pump

- ☐ Installing ➔ [page 77](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

6 - Fuel supply hose

7 - Fuel return hose

8 - O-ring

- ☐ Renew

9 - Fuel temperature sender - G81-

- ☐ 2 Nm

10 - High-pressure pipe

- ☐ Do not alter shape
- ☐ Check for damage before re-installing
- ☐ Always renew high-pressure pipe when renewing high-pressure pump
- ☐ Installing ➔ [page 77](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

11 - Bolt

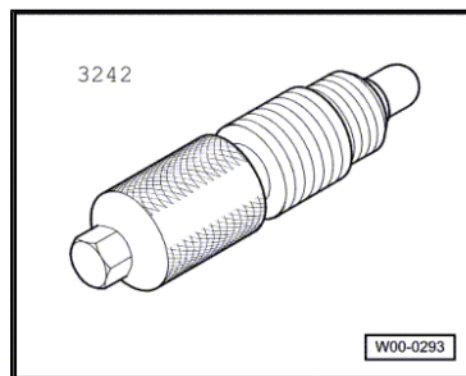
- ☐ 22 Nm

5.2 Removing and installing high-pressure pump

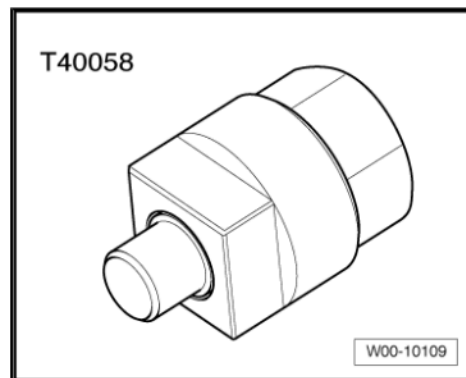
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Special tools and workshop equipment required

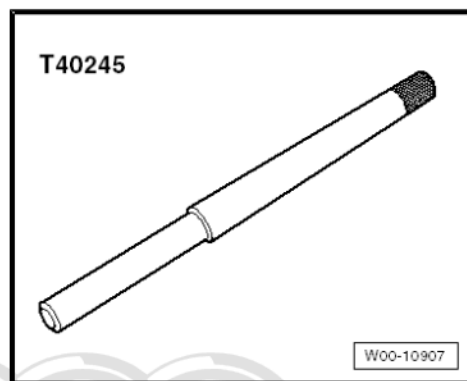
- ◆ Locking pin - 3242-



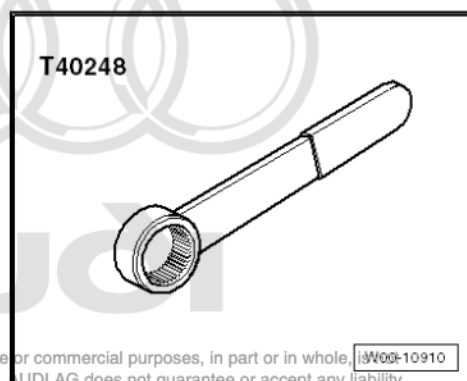
- ◆ Adapter - T40058-



◆ Locking pin -T40245-

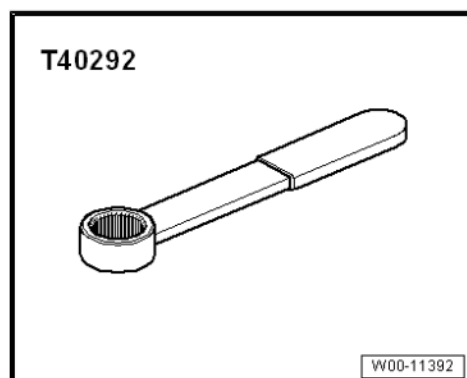


◆ Counterhold tool - T40248- or counterhold tool - T40292- (different types of adapters are fitted depending on version)



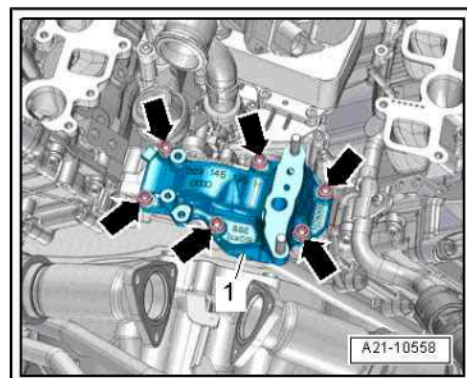
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◆ Counterhold tool - T40292-

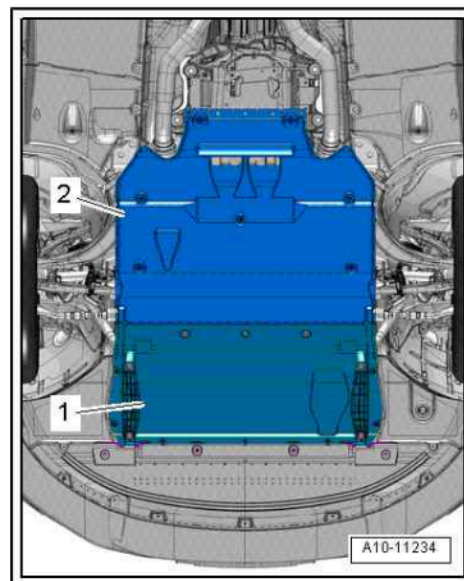


Removing

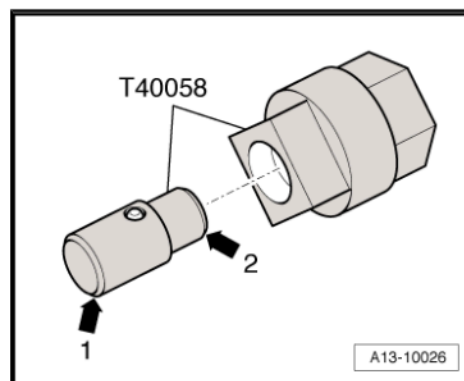
- Remove intake manifold ⇒ [page 36](#) .
- Remove turbocharger ⇒ Rep. gr. 21 .
- Remove engine oil cooler ⇒ Rep. gr. 17 .
- Remove coolant shut-off valve ⇒ Rep. gr. 19 .
- Unscrew bolts -arrows- and swivel bracket -1- for turbocharger to side.



- Remove rear noise insulation panel -1- ➔ Rep. gr. 66 .



- Insert guide pin of adapter -T40058- as follows:
 - The larger-diameter section -arrow 1- faces towards the engine.
 - The smaller-diameter section -arrow 2- faces the adapter.

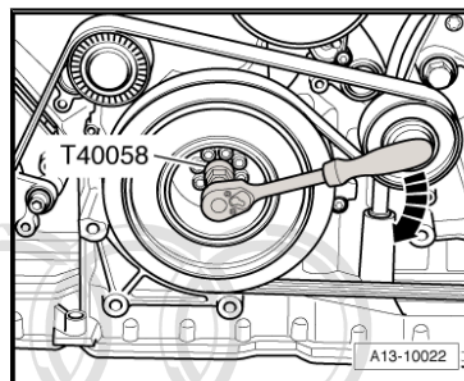


Caution

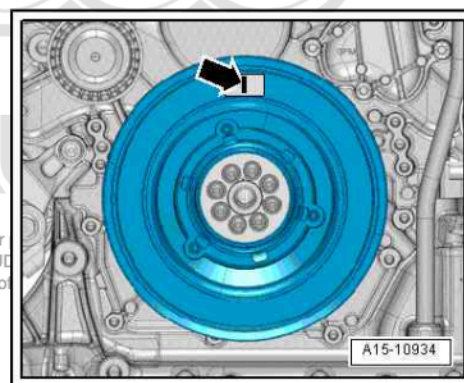
Irreparable damage can be caused if the camshaft timing chain slips.

- ◆ *Turn crankshaft only in direction of engine rotation -arrow-.*

- Use adapter - T40058- to turn crankshaft to “TDC” position.



- Mark -arrow- must be perpendicular to centre of crankshaft, as shown in illustration.



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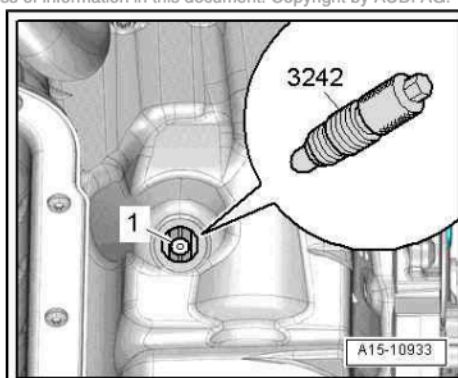
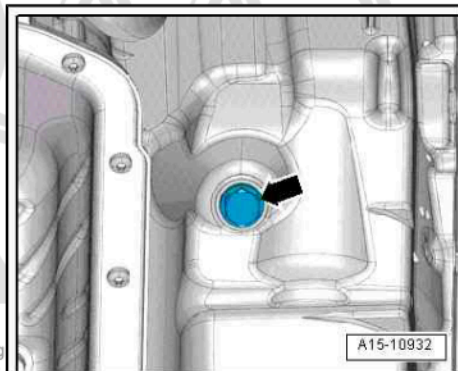
Note

Place a cloth beneath the sump (top section) to catch escaping oil.

- Unscrew plug -arrow- for “TDC” marking from sump (top section).

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- Screw locking pin - 3242- into hole (20 Nm); if necessary, turn crankshaft -1- backwards and forwards slightly to fully centralise locking pin.



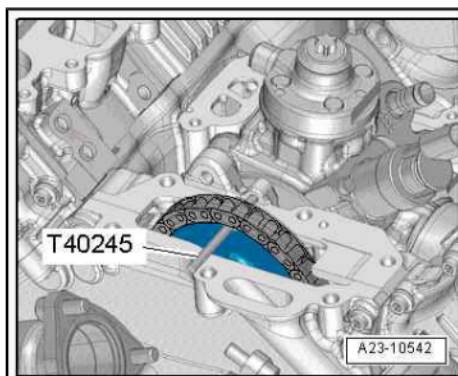
- Lock chain sprocket for high-pressure pump in position using locking pin -T40245- .



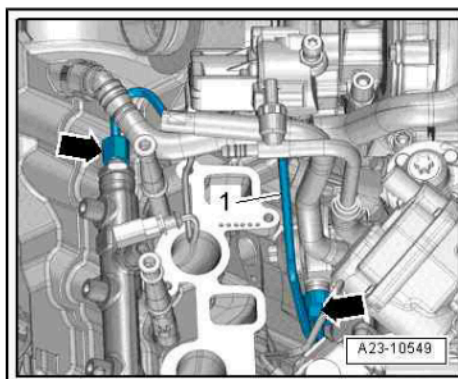
Caution

Risk of malfunctions caused by dirt.

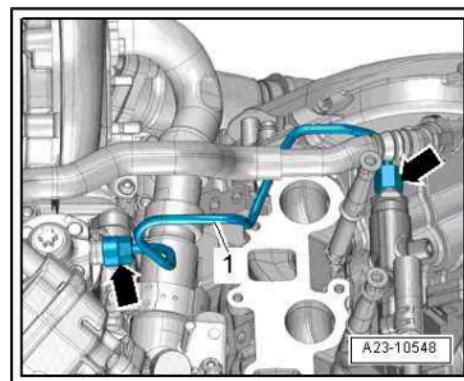
- ♦ Observe
⇒ “1.3 Safety precautions when working on the fuel system”, page 2 .



- Unscrew union nuts -arrows- and detach high-pressure pipe (right-side) -1-.



- Unscrew union nuts -arrows- and detach high-pressure pipe (left-side) -1-.
- Seal off open lines and connections with clean plugs.



- Unplug electrical connector -2-.
- Release hose clips -3 and 4- and detach fuel hoses.



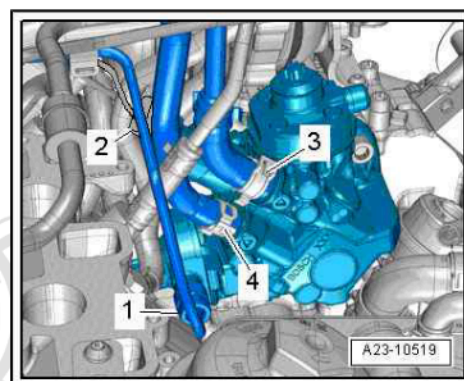
Note

Lay a cloth under the connection to catch escaping fuel.



Note

Disregard -item 1-.



- Unscrew bolts -arrows- and detach high-pressure pump.

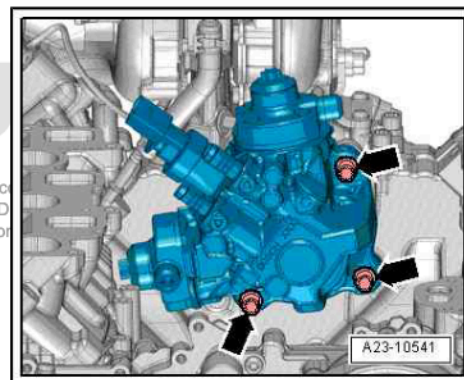
Installing

Installation is carried out in the reverse order; note the following:

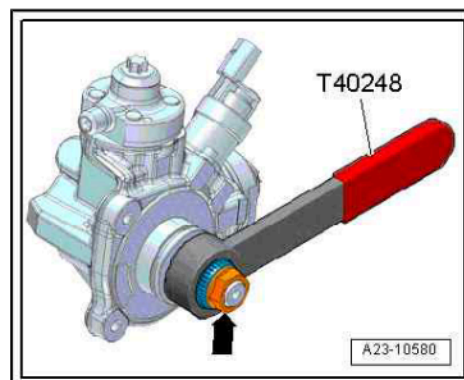
Tightening torques

- ♦ ⇒ ["5.1 Exploded view - high-pressure pump" - page 44](#)

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- When renewing high-pressure pump, install adapter from old high-pressure pump on new pump.
- Use counterhold tool - T40248- or counterhold tool - T40292- to loosen and tighten nut -arrow-.

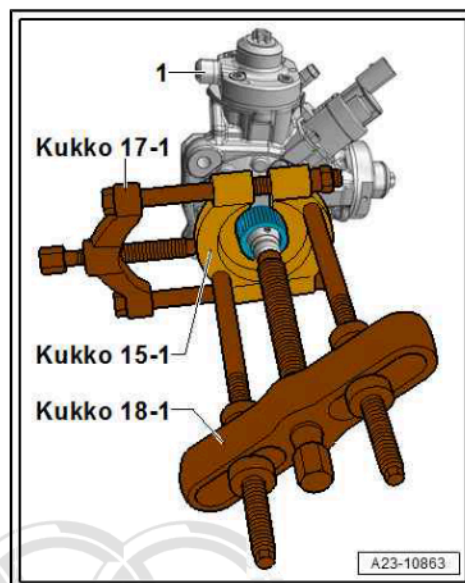


- Detach adapter from high-pressure pump -1-, as shown in illustration. Use commercially available pullers, e.g. Kukko 15-1/, 17-1/ and 18-1.

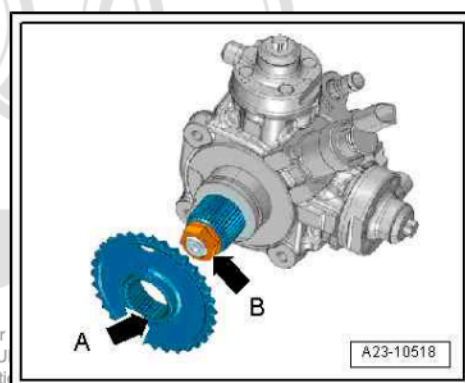


Note

- ◆ Different types of adapters are fitted depending on version.
- ◆ Always renew high-pressure pipes when renewing high-pressure pump.



- Insert high-pressure pump into chain sprocket.
- The dual toothing -arrow A- on the chain sprocket must align with the groove -arrow B- in the adapter on the high-pressure pump shaft.
- Remove locking pin - 3242- and locking pin -T40245- .
- Tighten plug for “TDC” drilling in sump (top section) ⇒ Rep. gr. 17 .
- Install high-pressure pipes ⇒ [page 77](#) .
- Install coolant shut-off valve ⇒ Rep. gr. 19 .
- Install engine oil cooler ⇒ Rep. gr. 17 .
- Install turbocharger ⇒ Rep. gr. 21 .
- Install intake manifold ⇒ [page 36](#) .
- Install rear noise insulation ⇒ Rep. gr. 66 .



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time ⇒ [page 50](#) .

5.3 Performing first fuel filling after installing high-pressure pump

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester



Caution

Running when dry causes irreparable damage to high-pressure pump.

- ◆ *After installing the high-pressure pump, the pump must first be filled with fuel before the engine is started for the first time.*



Note

- ◆ *When installing the high-pressure fuel pump, it is essential to ensure that no dirt enters the fuel system.*
- ◆ *Only remove sealing plugs immediately prior to installation of fuel lines.*
- ◆ *There must be sufficient fuel in the tank.*

Procedure

- Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.
- Connect a ⇒ Vehicle diagnostic tester.
- Switch on ignition.
- Select “Engine electronics” in vehicle self-diagnosis.
- Select “Guided Functions”.
- Then select “Activate fuel pump”.
- Select “120 seconds”.
- The fuel pump starts running.
- Repeat step.
- The fuel pump must run for approx. 4 minutes to ensure that the fuel system is filled sufficiently with fuel.
- Start engine after filling fuel system.
- Run engine at moderate speed for several minutes and then switch off.
- Check fuel system for leaks.
- Erase entry in event memory using ⇒ Vehicle diagnostic tester.
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode (‘emergency running’ mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- Interrogate event memory again.

6 Injectors

⇒ "6.1 Exploded view - injectors", page 52

⇒ "6.2 Checking injectors", page 55

⇒ "6.3 Performing adaption of correction values for injectors", page 56

⇒ "6.4 Checking for injectors sticking open", page 56

⇒ "6.5 Measuring return flow rate of injectors with engine running", page 60

⇒ "6.6 Checking return flow rate of injectors at starter cranking speed", page 63

⇒ "6.8 Removing and installing injectors", page 67

⇒ "6.10 Installing high-pressure pipes", page 77

6.1 Exploded view - injectors



Caution

Risk of malfunctions caused by dirt.

1 - Support bracket

- ☐ For clamping piece
- ☐ Different tightening torques:

◆ To camshaft bearing:
2.5 Nm

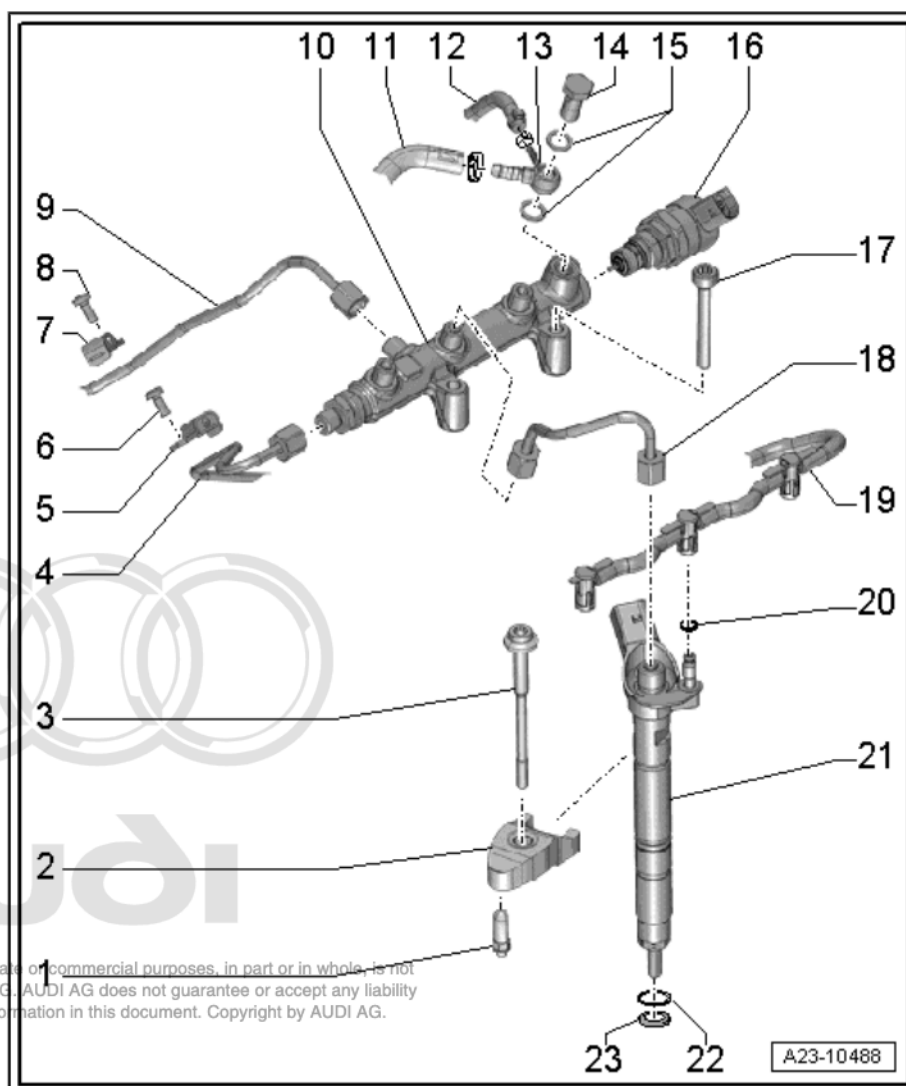
◆ To cylinder head: 9 Nm

2 - Clamping piece

- ☐ Use a coloured pen to mark injectors and corresponding clamping piece and cylinder for re-installation; pay attention to markings when installing
- ☐ If the injector is installed on another cylinder for testing purposes, the clamping piece must also be moved
- ☐ After looking for the fault, the injector and the clamping piece must be re-installed on their original cylinder
- ☐ The clamping pieces can be re-used when installing new injectors

3 - Bolt

- ☐ Renew
- ☐ Tighten initially to 6 Nm
- ☐ Then tighten 90° further



4 - High-pressure pipe

- ☐ From high-pressure pump to fuel rail
- ☐ Do not alter shape
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 77](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

5 - Retaining clamp

- ☐ For high-pressure pipe

6 - Bolt

- ☐ 9 Nm

7 - Retaining clamp

- ☐ For high-pressure pipe

8 - Bolt

- ☐ 9 Nm

9 - High-pressure pipe

- ☐ From fuel rail on opposite side
- ☐ Do not alter shape
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 77](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

10 - Fuel rail

- ☐ Removing and installing ⇒ [page 74](#)

11 - Fuel return hose

- ☐ To fuel tank

12 - Fuel return hose

- ☐ From injectors
- ☐ Do not dismantle
- ☐ Renew together with restrictor
- ☐ After renewing, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ☐ Then check fuel return hoses for leaks

13 - Ring connection for hose

14 - Banjo bolt

- ☐ 25 Nm

15 - Seals

- ☐ Renew

16 - Fuel pressure regulating valve - N276-

- ☐ With deformable sealing lip
- ☐ Cannot be re-installed
- ☐ After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , adaption must be performed. Use ⇒ Vehicle diagnostic tester
- ☐ Removing and installing ⇒ [page 83](#)
- ☐ Tightening torque ⇒ [page 54](#)

17 - Bolt

- ☐ 22 Nm

18 - High-pressure pipe

- ☐ From fuel rail to injector
- ☐ Do not alter shape
- ☐ Mark allocation for re-installation; pay attention to marking when installing
- ☐ Check for damage before re-installing
- ☐ Installing ⇒ [page 77](#)
- ☐ Lubricate threads of union nuts with clean engine oil
- ☐ 25 Nm

19 - Fuel return hose

- ☐ From injectors
- ☐ Do not dismantle
- ☐ Renew together with restrictor
- ☐ After renewing, engine must be run at idling speed for approx. 2 minutes to bleed fuel system
- ☐ Then check fuel return hoses for leaks

20 - O-ring

- ☐ Renew

21 - Injector

- ☐ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ☐ If the injector is installed on another cylinder for testing purposes, the clamping piece must also be moved
- ☐ Always renew copper seal when removing and installing
- ☐ After looking for the fault (switching the injectors around), the injector and the clamping piece must be re-installed on their original cylinder
- ☐ To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- ☐ Removing and installing ⇒ [page 67](#)

22 - O-ring

- ☐ Renew

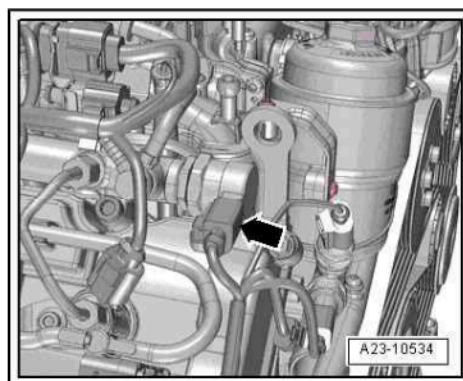
23 - Copper seal

- ☐ Always renew copper seal when removing and installing

Fuel pressure regulating valve - N276- - tightening torque

- Position fuel pressure regulating valve - N276- so that electrical wiring is not under tension when connector -arrow- is plugged in.
- Tighten union nut on regulating valve in 4 stages as follows (counterhold hexagon flats on housing):

Stage	Tightening torque
1.	Screw in by hand until contact is made
2.	60 Nm
3.	Turn back by 90°
4.	85 Nm



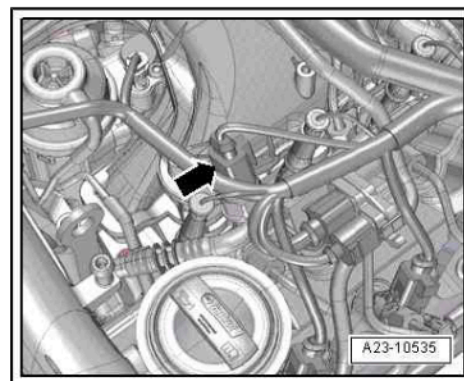
Fuel pressure sender - G247- - tightening torque

- Tighten fuel pressure sender - G247- in 4 stages as follows:



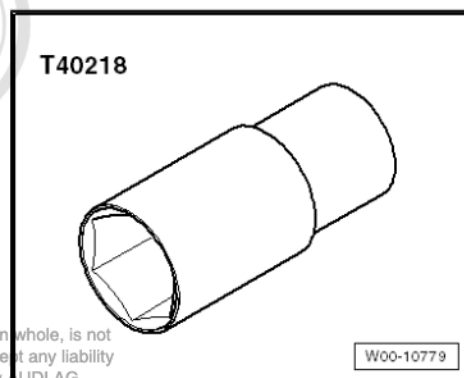
Note

An open-end spanner must not be used for loosening or tightening.



Special tools and workshop equipment required

- ◆ Socket, 27 mm - T40218-



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- ◆ Torque wrench

Stage	Tightening torque
1.	Screw in by hand until contact is made
2.	60 Nm
3.	Turn back by 180°
4.	85 Nm

6.2 Checking injectors

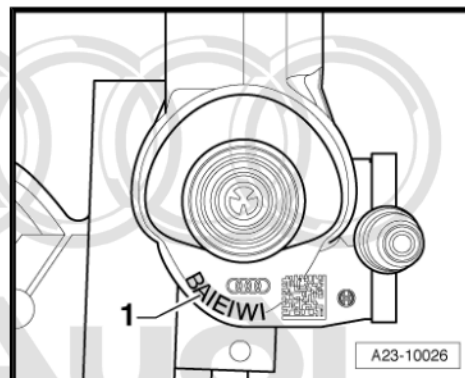
There are four different tests for checking the operation of the injectors.

- ⇒ ["6.3 Performing adaption of correction values for injectors", page 56](#) .
- ⇒ ["6.4 Checking for injectors sticking open", page 56](#) .
- ⇒ ["6.5 Measuring return flow rate of injectors with engine running", page 60](#) .
- ⇒ ["6.6 Checking return flow rate of injectors at starter cranking speed", page 63](#) .

Perform the following tests first if the engine does not start at all:

- ◆ ⇒ ["6.4 Checking for injectors sticking open", page 56](#) .
- ◆ ⇒ ["6.6 Checking return flow rate of injectors at starter cranking speed", page 63](#) .
- ◆ ⇒ ["7.2 Checking fuel pressure regulating valve N276", page 81](#) .

6.3 Performing adaption of correction values for injectors



- ◆ The "Injector delivery calibration" and "Injector voltage calibration" serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- ◆ The 7-digit adaption value -1- (example) is marked separately on each injector. It may consist of letters and/or numbers (AS-CII code).
- ◆ Reference table for reading out letters and/or numbers on each injector



Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester

The adaption procedure is described in the "Guided Fault Finding". (The procedure is also described under "Guided Functions".)
Use ➔ Vehicle diagnostic tester.

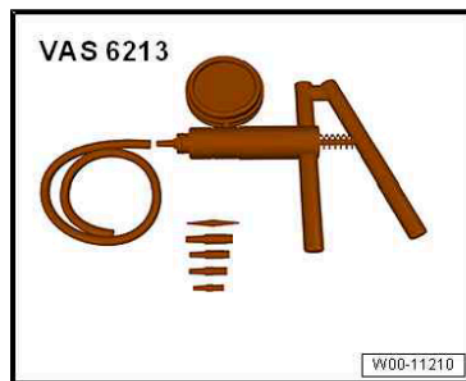
- When a new injector is installed, the adaption value for the new injector must be stored in the engine control unit.
- Additionally, check that the "Injector delivery calibration values" with "Injector voltage calibration values" are correctly entered for all the other injectors. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.
- When the engine control unit is renewed, the appropriate "Injector delivery calibration values" with "Injector voltage calibration" values must be written into the new engine control unit.

6.4 Checking for injectors sticking open

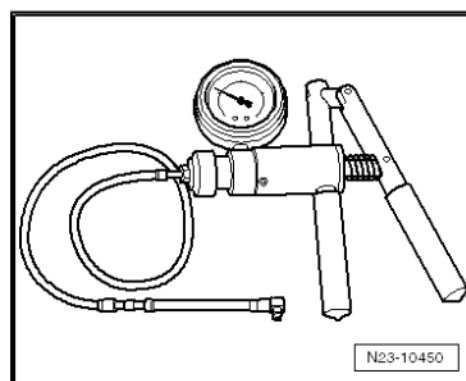
If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

- ◆ Hand vacuum pump - VAS 6213-



- ◆ Use a return line to make an -adapter-.



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Procedure

- Remove engine cover panel ➔ [page 31](#) .
- Clean all fuel rail connections with engine cleaner or brake cleaner and dry.

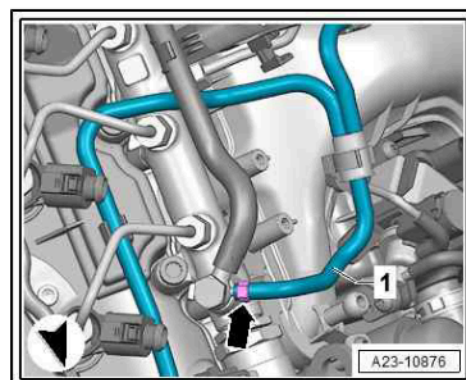


Caution

Risk of malfunctions caused by dirt.

- ◆ *Observe*
➔ *"1.3 Safety precautions when working on the fuel system", page 2* .

- Open clip -arrow- and detach fuel return hose -1- from banjo bolt.



- Connect hand vacuum pump - VAS 6213- to fuel return hose -1-.



Note

Make sure you do not widen the fuel return hose -1- when attaching the adapter of the hand vacuum pump - VAS 6213- .

- Create vacuum of -500 mbar with hand vacuum pump - VAS 6213- .

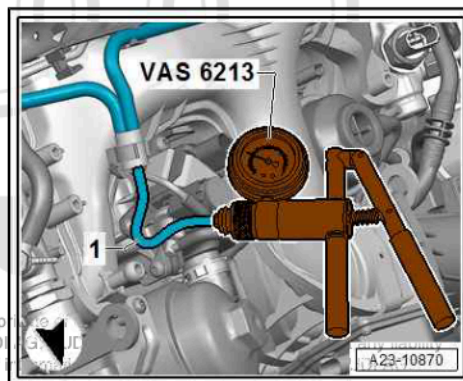
If the vacuum reading remains the same for 30 seconds, the injectors are OK.

In the case of a faulty injector, the vacuum will fall back to 0 bar within 2 to 3 seconds.

If pressure drops, check injectors on individual cylinder banks.

Check all cylinders in turn.

Starting with cylinder 1



- Disconnect fuel return hoses from injectors you want to check; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



Note

Illustration shows cylinder bank 1.

- Connect adapter to return line connection of injector to be tested after adapter has been cleaned and blown out.
- Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

If the vacuum reading remains the same for 30 seconds, the injector is OK.

In the case of a faulty injector, the vacuum will fall back to 0 bar within 2 to 3 seconds.

Repeat test if necessary; note drop in vacuum reading on hand vacuum pump - VAS 6213- .

- Renew faulty injectors ➔ [page 67](#) .
- Secure fuel return hose to banjo bolt with new clip.

Assembling

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all O-rings with engine oil or assembly oil before installing.

- Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.

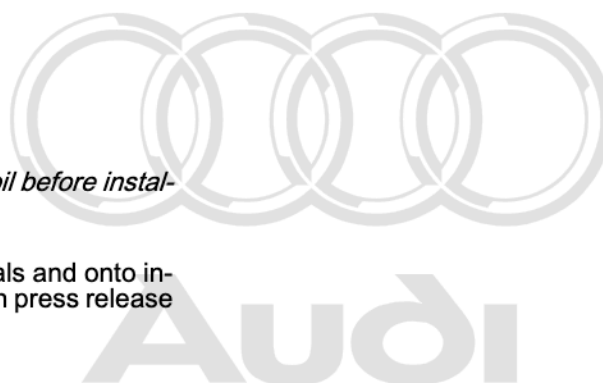
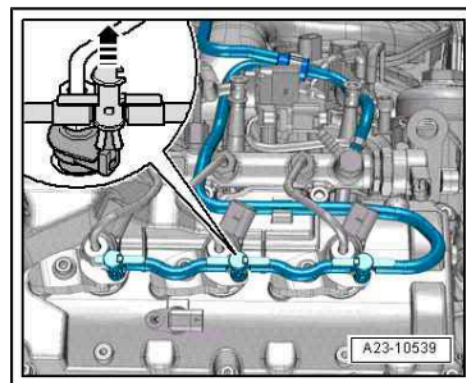
Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ➔ [page 31](#) .



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

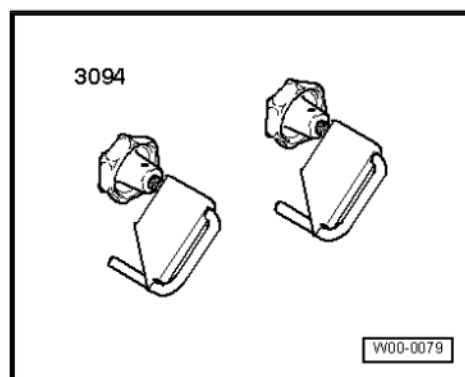


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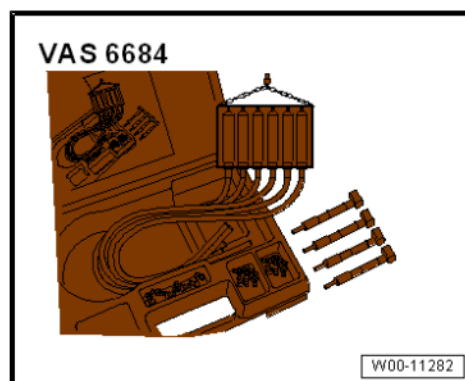
6.5 Measuring return flow rate of injectors with engine running

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-



- ◆ Return flow meter - VAS 6684-



- ◆ Fuel-resistant measuring container



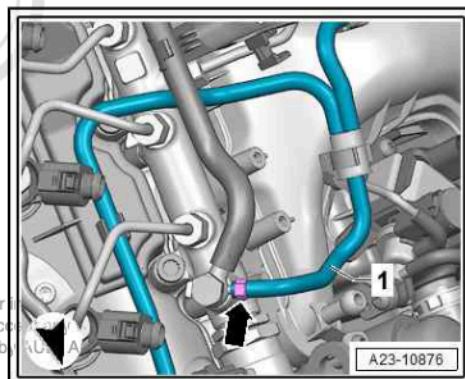
Caution

Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ "1.3 Safety precautions when working on the fuel system", page 2.

Measuring return flow rate of all injectors

- Pull off engine cover panel ⇒ [page 31](#) .
- Open clip -arrow- and detach fuel return hose -1- from banjo bolt.



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- Seal off open connection at banjo bolt with plug -arrow-.
- Hold fuel return hose -1- into a suitable measuring container (lengthen hose if necessary).
- Start engine and run at idling speed for two minutes:
 - ◆ Return flow rate after 2 minutes: 0 ... 50 ml
- If specification is attained, increase engine speed to 2000 ... 2500 rpm for approx. two minutes:
 - Return flow rate after 2 minutes: less than 250 ml

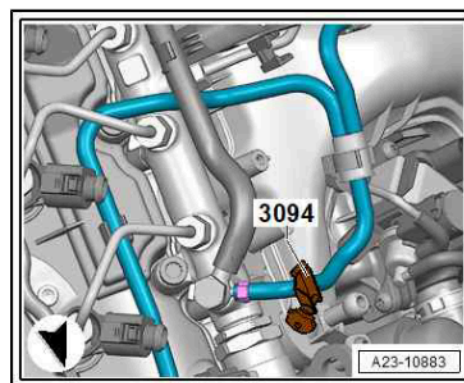
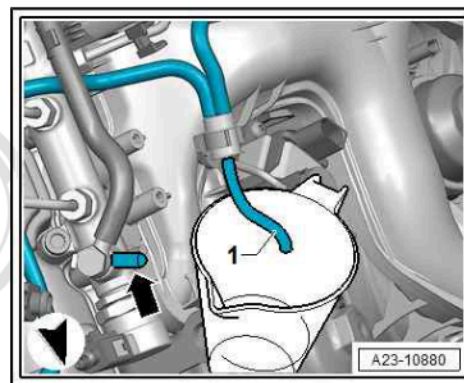
If specification is exceeded, this indicates that one or more injectors are defective.

- Secure fuel return hose to banjo bolt with new clip.

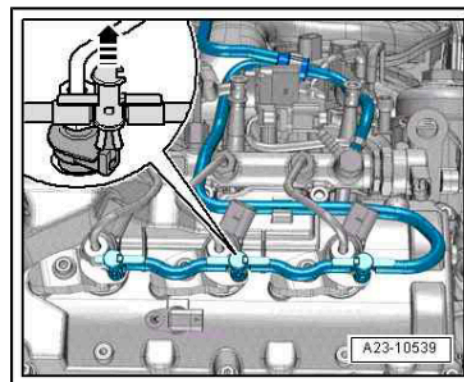
Measuring return flow rate of individual injectors

Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

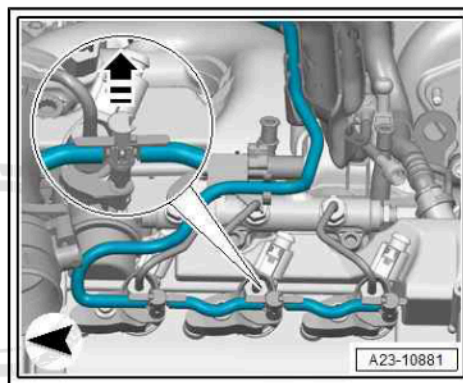
- Pull off engine cover panel ➔ [page 31](#) .
- Clean all return line connections with engine cleaner or brake cleaner and dry.
- Clamp off fuel return line downstream of restrictor using hose clamp up to 25 mm - 3094- .



- Disconnect fuel return hoses from injectors on cylinder bank 1; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Disconnect fuel return hoses from injectors on cylinder bank 2; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Connect hoses of return flow meter - VAS 6684- to all return line connections of the six injectors.
- Start engine and run at idling speed for several minutes:

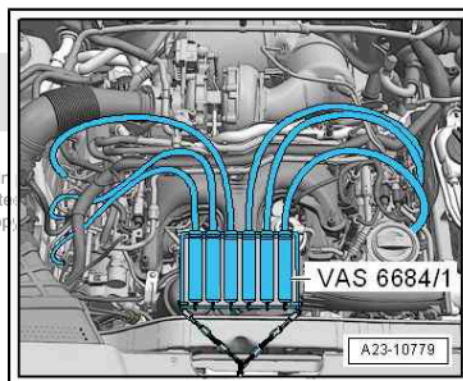


Caution

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Risk of damage to injectors due to increased engine speed.

- ◆ **Do NOT press the accelerator during this test; the engine must only run at idling speed.**



- When the engine is warm and running at idling speed, the return flow rates at each of the 6 injectors must not differ by more than a small amount.

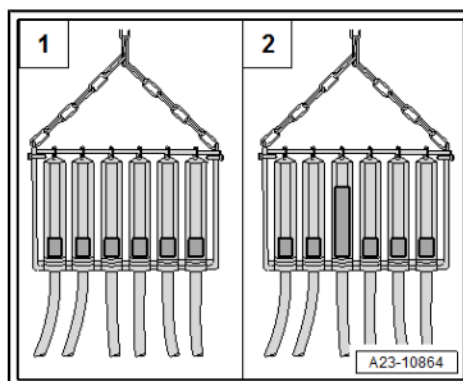
Evaluating return flow rate:

- ◆ 1 = injectors OK; return flow rate approx. identical on all injectors.
- ◆ 2 = injector for cylinder 3 not OK; return flow rate surpasses value three times the volume of smallest measured return flow rate.



Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate.



- If one injector has a significantly higher return flow rate than the others it must be renewed ⇒ [page 67](#) .

- Remove hose clamp up to 25 mm - 3094- from fuel return line.

Assembling

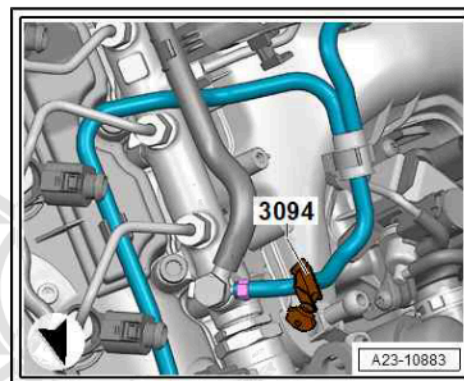
- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all O-rings with engine oil or assembly oil before installing.



- Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ➔ [page 31](#) .



Note

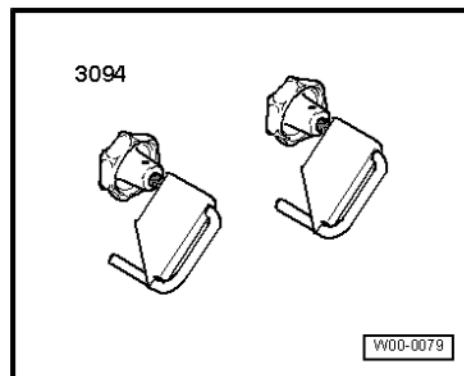
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

6.6 Checking return flow rate of injectors at starter cranking speed

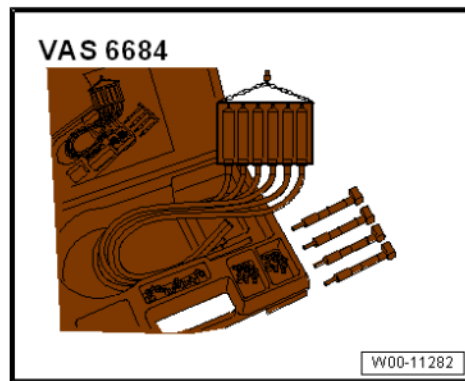
Only perform this test if the engine does not start at all.

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-



◆ Return flow meter - VAS 6684-



Caution

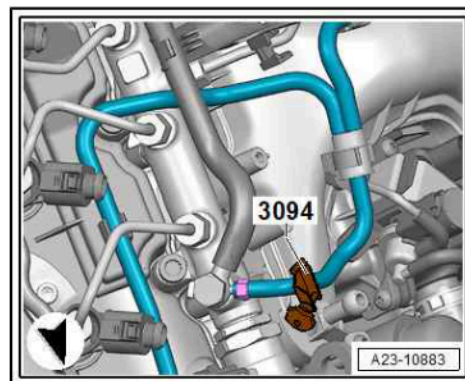
Risk of malfunctions caused by dirt.

- ◆ **Observe**
⇒ *"1.3 Safety precautions when working on the fuel system", page 2*.

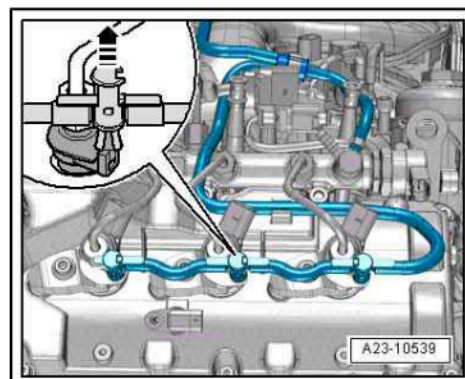
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Measuring return flow rate of individual injectors.
Each injector normally has a relatively low return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

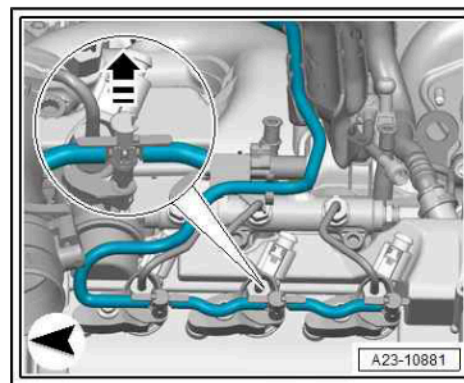
- Pull off engine cover panel ⇒ [page 31](#) .
- Clean all return line connections with engine cleaner or brake cleaner and dry.
- Clamp off fuel return line downstream of restrictor using hose clamp up to 25 mm - 3094- .



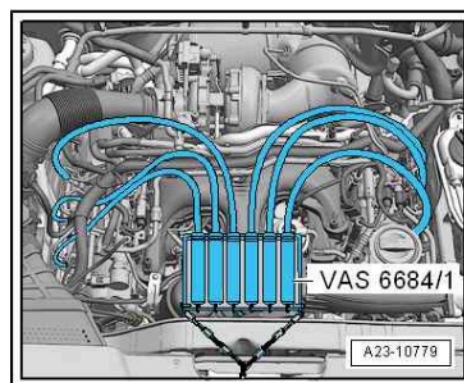
- Disconnect fuel return hoses from injectors on cylinder bank 1; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Disconnect fuel return hoses from injectors on cylinder bank 2; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.



- Connect hoses of return flow meter - VAS 6684- to all return line connections of the six injectors.
- Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).
- Specification of return flow rate: 0 ml
- If fuel comes out of one injector, that injector must be renewed
⇒ [page 67](#).



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- Remove hose clamp up to 25 mm - 3094- from fuel return line.

Assembling

- Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.



Note

Lubricate all O-rings with engine oil or assembly oil before installing.

- Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.
- Entries are stored in the event memory of the engine control unit because electrical connectors were unplugged: Interrogate and erase event memory.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.
- Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ➔ [page 31](#) .



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

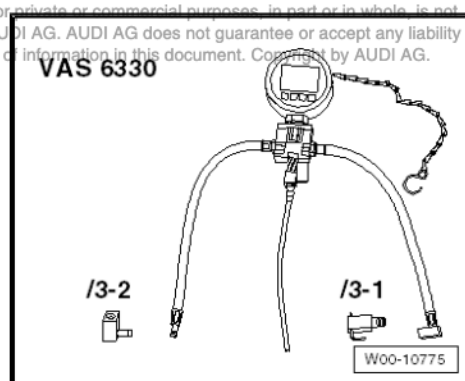
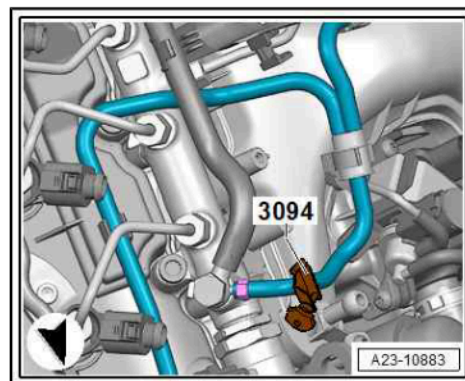
6.7 Checking restrictor in fuel return line

On vehicles with fuel systems with 6 bar, the restrictor maintains a constant residual pressure in the fuel return line. This residual pressure is required for the control function of the injectors.

Special tools and workshop equipment required

- ◆ Tester for fuel return system - VAS 6330-

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Caution

Risk of malfunctions caused by dirt.

◆ **Observe**

⇒ "1.3 Safety precautions when working on the fuel system", page 2.

- Pull off engine cover panel ⇒ [page 31](#) .
- Clean return line connection on cylinder 1 (with commercial cleaning solution or similar) before removing.
- Dry return line connection on cylinder 1.
- Cover return line connection on cylinder 1 with a cloth.
- Detach return line connection from cylinder 1. To do so, press tabs down and pull centre piece up to release connection.

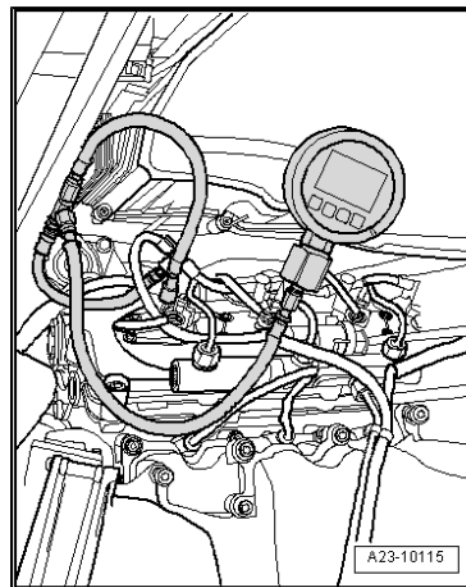


Note

No dirt must be allowed to get into the disconnected return line or the open connection on the injector.

- Connect tester for fuel return system - VAS 6330- between return line connection on injector and return line.
- Start engine.
- Check pressure indicated on tester.
- ◆ Specification: approx. 4 bar

If specification is not attained, renew fuel return line with restrictor.



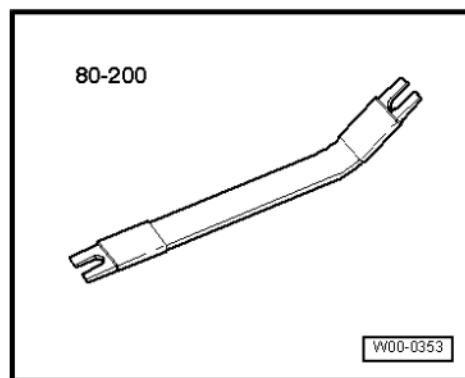
6.8 Removing and installing injectors

Special tools and workshop equipment required

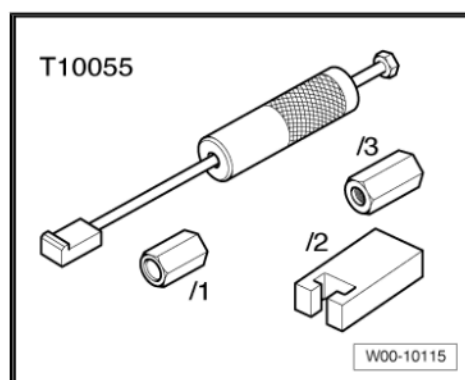
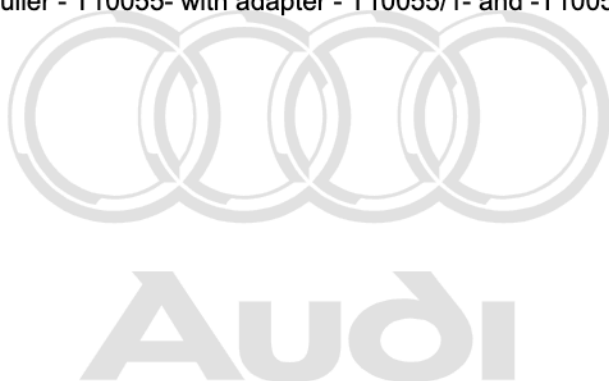
- ◆ Cleaning kit - VAS 6811-



◆ Removal lever - 80 - 200-

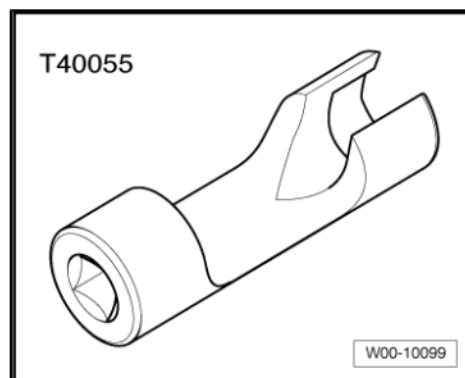


◆ Puller - T10055- with adapter - T10055/1- and -T10055/3-

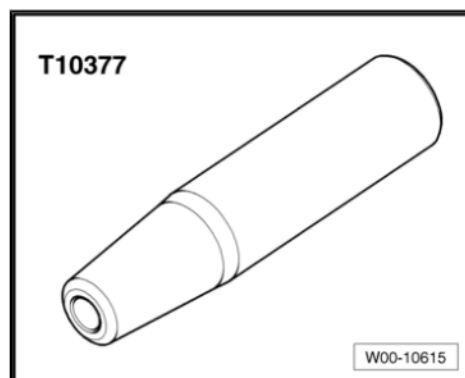


◆ Socket - T40055-

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◆ Assembly sleeve - T10377-



Removing



Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

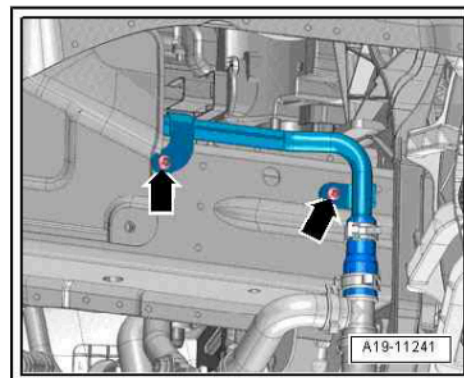
- Pull off engine cover panel ➔ [page 31](#) .

Cylinder bank 1 (right-side):

- Remove air cleaner housing ➔ [page 33](#) .

Cylinder bank 2 (left-side):

- Unscrew nuts -arrows- and move clear coolant pipe on longitudinal member.

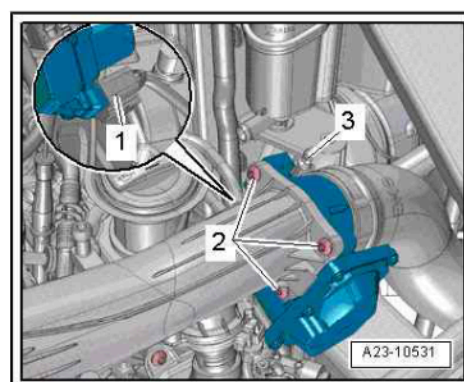


- Release hose clip -3- and detach air hose.

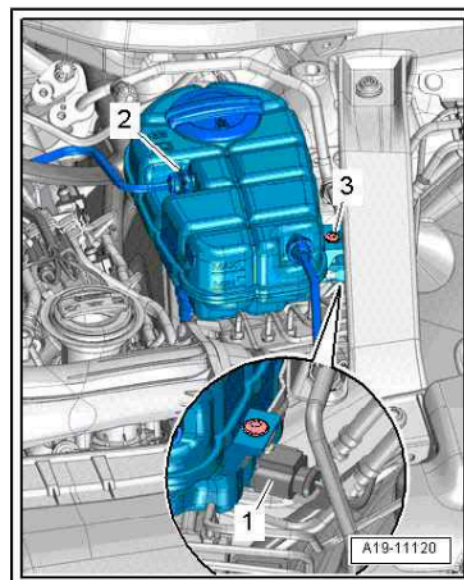


Note

Disregard -items 1, 2-.



- Unplug electrical connector -1-.
- Remove bolt -3-.
- Lift retaining clip -2- and disconnect coolant line.
- Place coolant expansion tank to one side.
- Seal off open lines and connections with clean plugs.



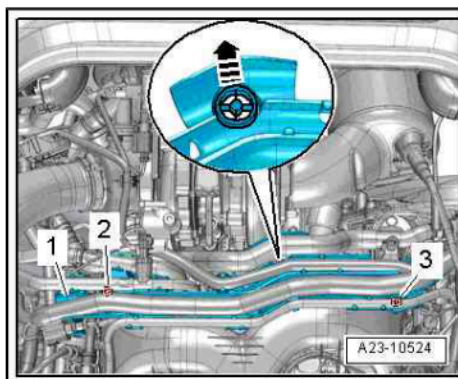
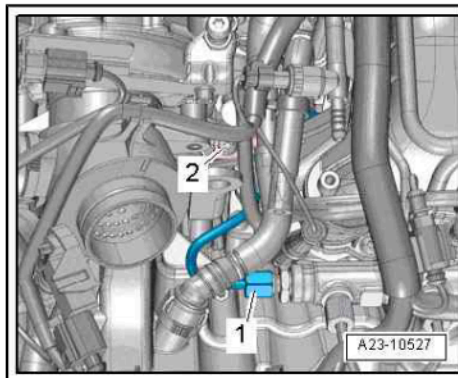
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Continuation for both sides

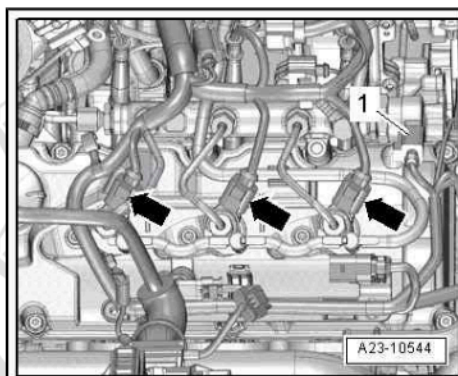

Caution
Risk of malfunctions caused by dirt.
◆ Observe

⇒ "1.3 Safety precautions when working on the fuel system", page 2.

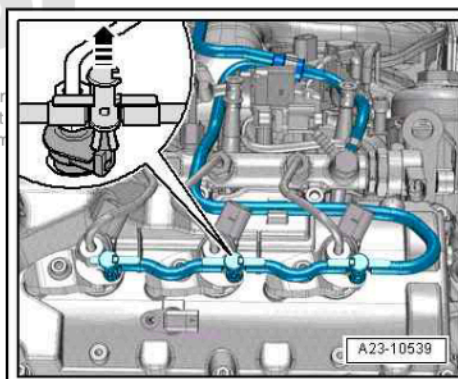
- Unscrew union nut -1- and bolt -2-.
- Use removal lever - 80 - 200- to move electrical wiring harness and hoses clear at cable guide -1-.
- Pull coolant hose off to rear -arrow-.
- Unscrew bolts -2 and 3- and remove cable guide.



- Unplug electrical connectors at injectors -arrows- and at fuel pressure regulating valve - N276- -item 1-.
- Move clear electrical wiring harness at cylinder head cover and fuel rail.



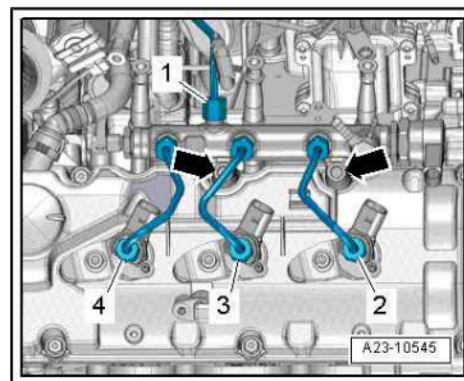
- Disconnect fuel return hoses from injectors; to do so, press down both tabs and at the same time pull centre piece up to release connection -arrow-.


Caution
Used injectors must always be re-installed on the same cylinder.

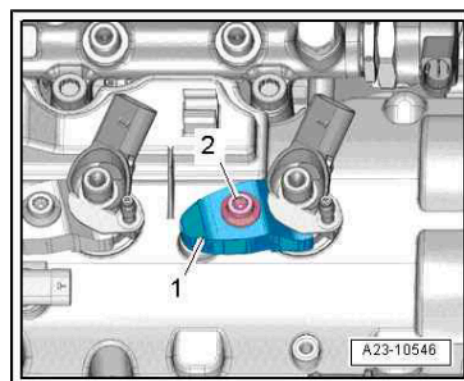
- ◆ *Mark injectors to ensure that they are re-installed at the correct cylinders.*

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- Loosen union nuts for high-pressure pipes -2, 3 and 4- using socket - T40055- .
- Seal off open lines and connections with clean plugs.



- Mark position of clamping piece -1- in relation to injector with paint for re-installation.
- Unscrew bolt -2- and detach clamping piece.
- Repeat work steps on remaining injectors.



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- Apply puller - T10055- with adapter -T10055/1- to injector, as shown in illustration. Pull off injector by tapping gently.
- Place removed injectors on a clean cloth.

Installing

Installing new injectors

When installing a new injector, the following components must be renewed:

- ◆ Bolt for clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection

Installing used injectors

When re-installing a used injector in the same cylinder, the following components must be renewed:

- ◆ Bolt for clamping piece
- ◆ Copper seal
- ◆ O-ring for injector bore
- ◆ O-ring for fuel return line connection
- Spray tip of injector nozzle with rust-solvent spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.
- To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.
- Clean off deposits under the copper seal using a suitable scraper.

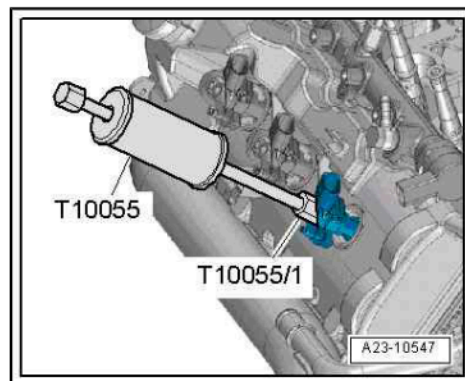
Continued (same procedure for used and new injectors):



Caution

Risk of damage to injector sealing surface.

- ◆ *To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- .*



- Fit new copper seal.
- Lubricate all O-rings with engine oil or assembly oil before installing.

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- Renew O-ring for injector bore using assembly sleeve - T10377- .
- Install injectors.

Remaining installation steps are carried out in reverse sequence; note the following:

Tightening torques

◆ ⇒ [“6.1 Exploded view - injectors”, page 52](#)

- Install high-pressure pipes ⇒ [page 77](#) .



Note

Lubricate all O-rings with engine oil or assembly oil before installing.

- Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

After renewing one or more injectors, the “injector delivery calibration values” and “injector voltage calibration values” for the new injectors must be written into the engine control unit
 ⇒ [page 56](#) .

Additionally, check that the “injector delivery calibration values” and “injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these calibration values if the correct values are already stored in the engine control unit.

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off.



Note

The fuel system is self-bleeding; do not open the high-pressure connections.

- Switch off ignition.
- Carefully check the complete fuel system including all 6 return line connections for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

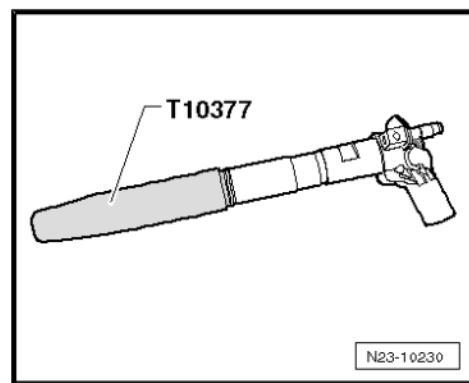
- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then inspect high-pressure section of fuel system again for leaks.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- Interrogate the event memory again after road-testing.

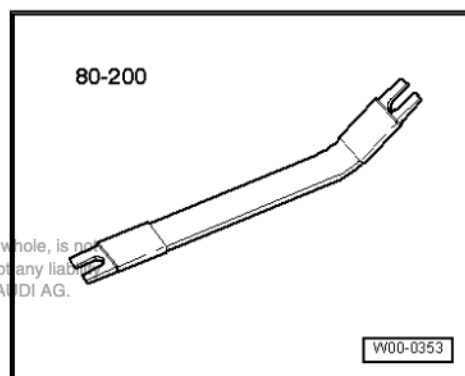




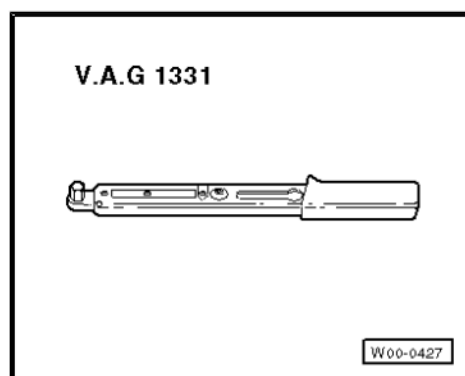
6.9 Removing and installing fuel rail

Special tools and workshop equipment required

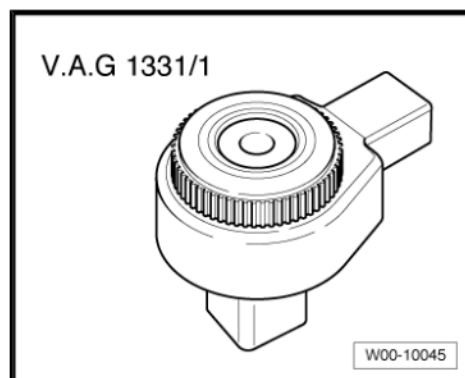
◆ Removal lever - 80 - 200-



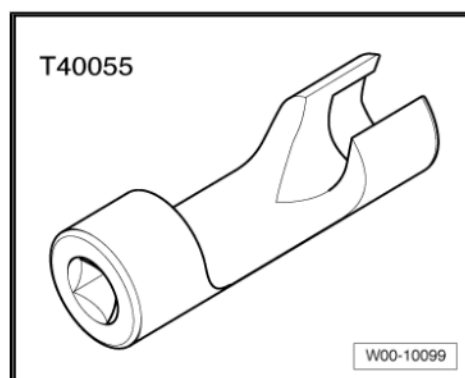
◆ Torque wrench - V.A.G 1331-



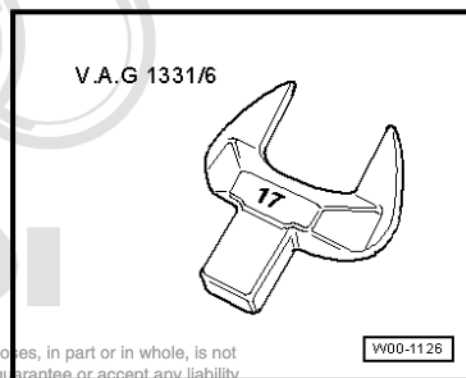
◆ Ratchet - V.A.G 1331/1-



◆ Socket - T40055-

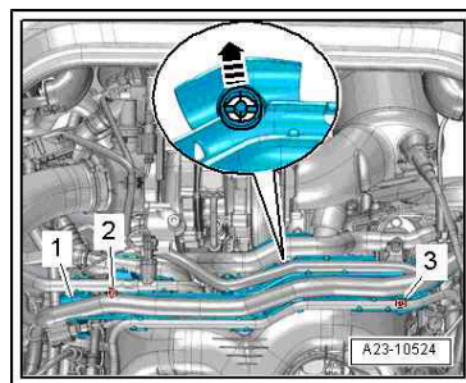


- ◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



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- Pull off engine cover panel ➔ [page 31](#) .
- Use removal lever - 80 - 200- to move electrical wiring harness and hoses clear at cable guide -1-.
- Pull coolant hose off to rear -arrow-.
- Remove bolts -2, 3- and move cable guide to rear.



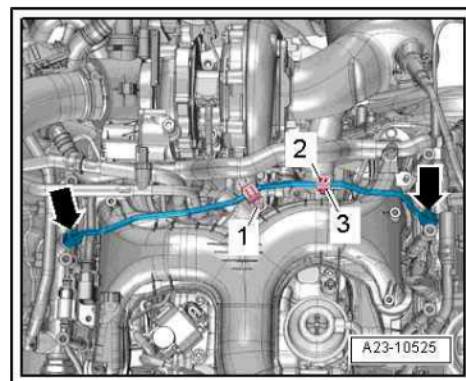
- Unscrew union nut on fuel rail to be removed.



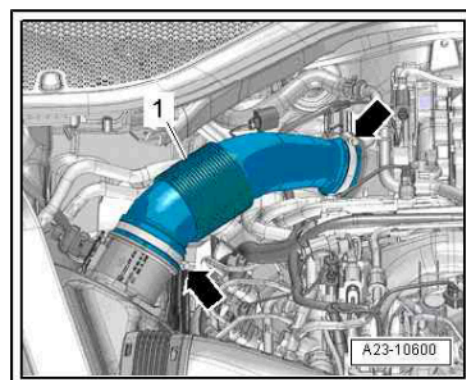
Note

- ◆ -Left arrow- for fuel rail on cylinder bank 1
- ◆ -Right arrow- for fuel rail on cylinder bank 2

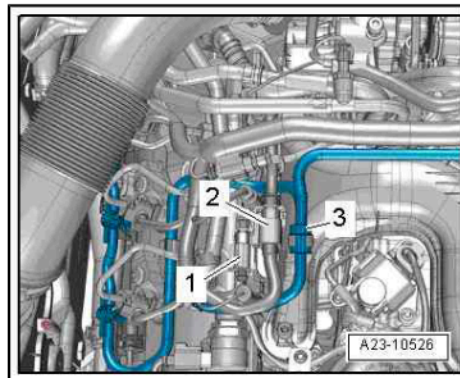
Fuel rail on cylinder bank 1



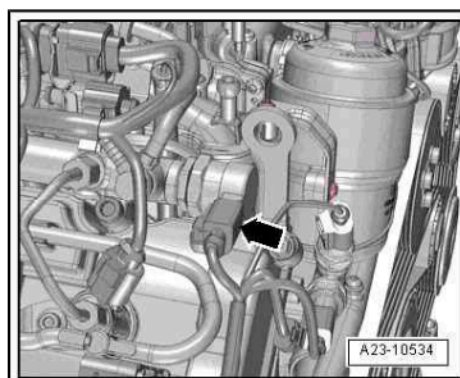
- Release hose clips -arrows- and remove air pipe -1-.



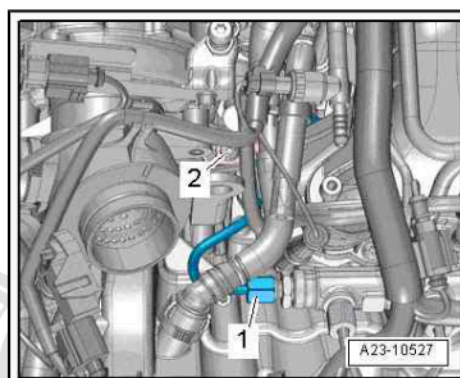
- Detach electrical connectors -1 and 2- and remove non-return valve -3- from bracket.



- Unplug electrical connector -arrow- at fuel pressure regulating valve - N276- .

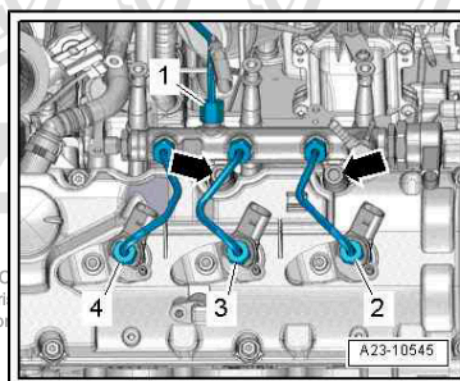


- Remove union nut -1- on fuel rail.
- Remove banjo bolt ⇒ [Item 14 \(page 53\)](#) for fuel return lines from fuel rail.



- Loosen union nuts of high-pressure pipes -2, 3 and 4-.
- Remove bolts -arrows- from fuel rail and place them down carefully on a clean surface.
- Seal off open lines and connections with clean plugs.

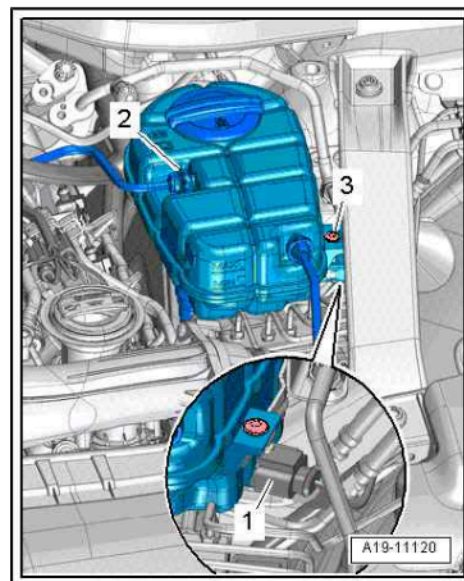
Fuel rail on cylinder bank 2



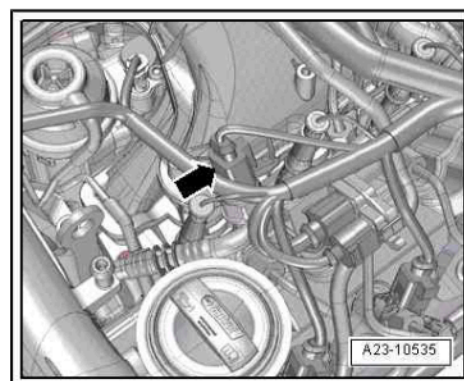
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- Unplug electrical connector -1-.
- Remove bolt -3-.
- Lift retaining clip -2- and disconnect coolant line.
- Place coolant expansion tank to one side.
- Seal off open lines and connections with clean plugs.



- Unplug electrical connector at fuel pressure sender - G247-
 -arrow-.



- Unclip bracket for electrical connectors -6 and 7-.
- Move clear electrical wiring harness.
- Remove union nut of rear fuel supply line on fuel rail.
- Unscrew union nuts for high-pressure pipes between injectors and fuel rail.
- Remove bolts from fuel rail and place them down carefully on a clean surface.
- Seal off open lines and connections with clean plugs.

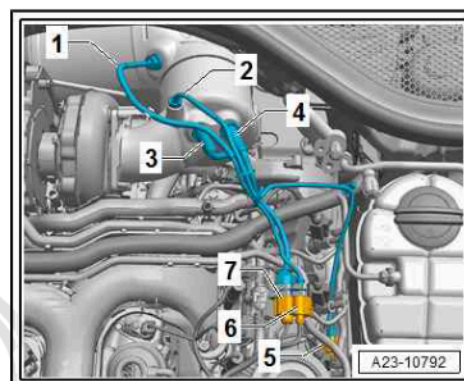
Installing

Installation is carried out in the reverse order; note the following:

- Install high-pressure pipes ⇒ [page 77](#) .

Tightening torques

- ◆ Exploded view - injectors
 ⇒ ["6.1 Exploded view - injectors", page 52](#)

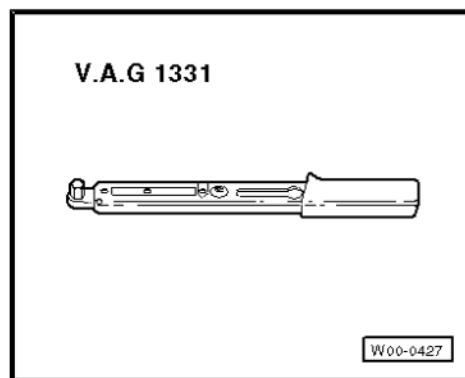


6.10 Installing high-pressure pipes

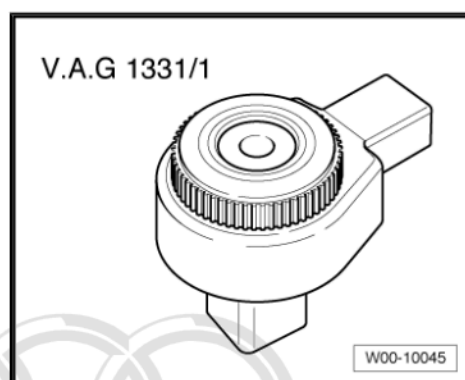
Special tools and workshop equipment required

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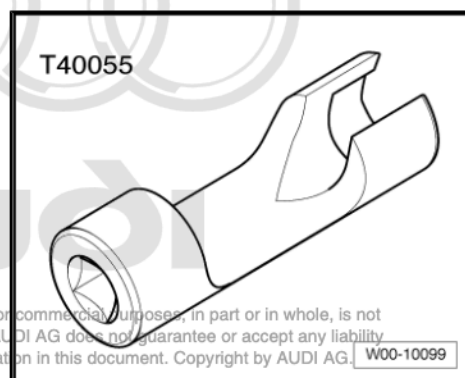
◆ Torque wrench - V.A.G 1331-



◆ Ratchet - V.A.G 1331/1-



◆ Socket - T40055-



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◆ Open end spanner insert, AF 17 - V.A.G 1331/6-

Procedure



Note

- ◆ *Before re-installation, check taper seats for deformation, cracks, damage, scores and corrosion. Renew high-pressure pipes if they are damaged or corroded.*
- ◆ *Check that bore in pipe is not distorted, restricted or damaged in any other way.*
- ◆ *When re-installing "old" high-pressure pipe, observe marking for installation position.*
- Use vacuum cleaner to remove dirt from taper seat at fuel rail.
- Clean fuel pipe and end of pipe with engine cleaner or brake cleaner and dry.
- Lubricate threads of union nuts with clean engine oil.

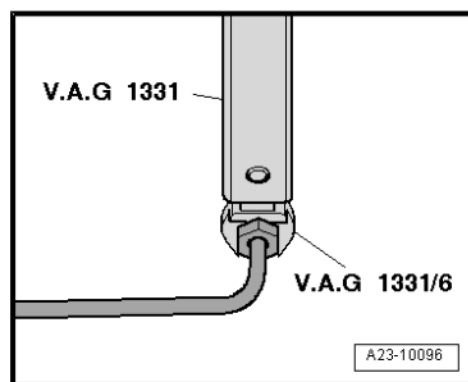
- Hand-tighten union nuts on high-pressure pipes until they make contact (ensure that pipes are not under tension).

Tightening torques

- ◆ ⇒ **"6.1 Exploded view - injectors", page 52** .

Union nuts (AF 17) on fuel rail:

- To secure high-pressure pipes, use torque wrench - V.A.G 1331- with open end spanner insert, AF 17 - V.A.G 1331/6- .

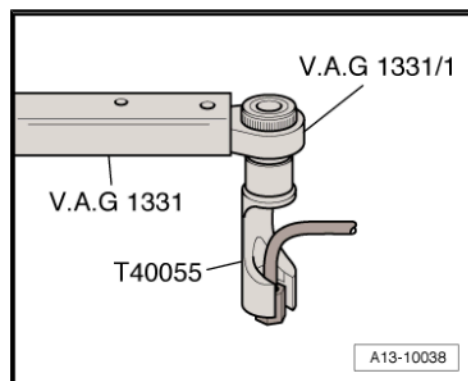


Union nuts (AF 17) on injectors:

- To tighten unions of injectors, use torque wrench - V.A.G 1331- with ratchet - V.A.G 1331/1- and socket - T40055- .

Bleeding fuel system and checking for leaks

- Run engine at idling speed for several minutes (do not press accelerator) and then switch off.



Note

The fuel system is self-bleeding; do not open the high-pressure connections.

- Switch off ignition.
- Carefully check the complete fuel system including all 6 return line connections for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then inspect high-pressure section of fuel system again for leaks.



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- Interrogate the event memory again after road-testing.

7 Senders and sensors

⇒ "7.1 Removing and installing air mass meter G70 ", page 80

⇒ "7.2 Checking fuel pressure regulating valve N276 ", page 81

⇒ "7.3 Removing and installing fuel pressure regulating valve N276 ", page 83

⇒ "7.4 Removing and installing fuel pressure sender G247 ", page 85

⇒ "7.5 Removing and installing pressure differential sender G505 ", page 88

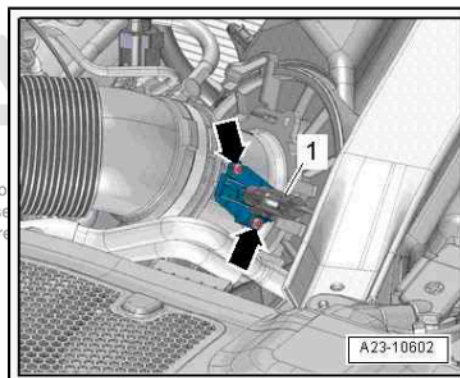
7.1 Removing and installing air mass meter - G70-

Removing

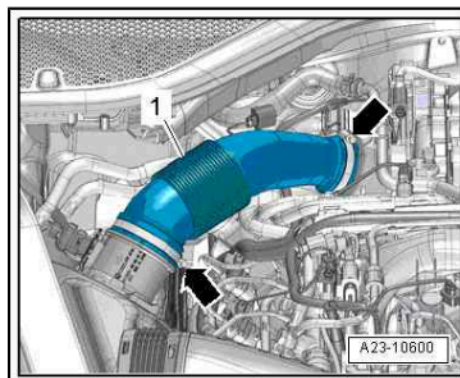
- Unplug electrical connector -1-.

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is not liability G.



- Release hose clips -arrows- and remove air pipe -1-.
- Release catch -1-, turn cover for air cleaner housing with air mass meter - G70- in anti-clockwise direction -arrow A- and detach.



- Release catches and detach air mass meter - G70- from cover.

Installing

Installation is carried out in the reverse order; note the following:

Tightening torques

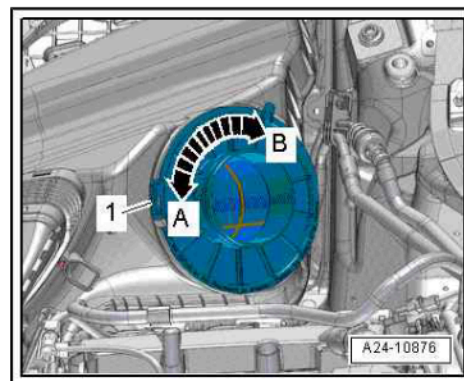
- ◆ ⇒ [“3.1 Exploded view - air cleaner”, page 30](#)

To ensure that the air mass meter - G70- functions properly, it is important to observe the following notes and instructions.



Note

- ◆ *If the air filter element is very dirty or wet, dirt or water could reach the air mass meter and affect the air mass value. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always renew seal for air mass meter if damaged (air leaks in intake system).*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Electronic parts catalogue](#) .*



7.2 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- ◆ Hose clamps, up to 25 mm - 3094-



- ◆ Fuel-resistant measuring container
- ◆ Test hose for return line connection

Procedure



WARNING

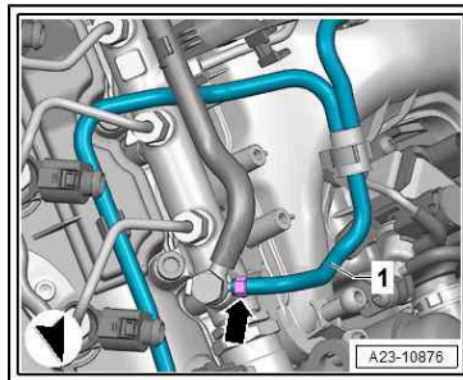
Risk of malfunctions caused by dirt.

- ◆ *Observe*
 ⇒ [“1.3 Safety precautions when working on the fuel system”, page 2](#) .

- Pull off engine cover panel ⇒ [page 31](#).

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- Open clip -arrow- and detach fuel return hose -1- from banjo bolt.

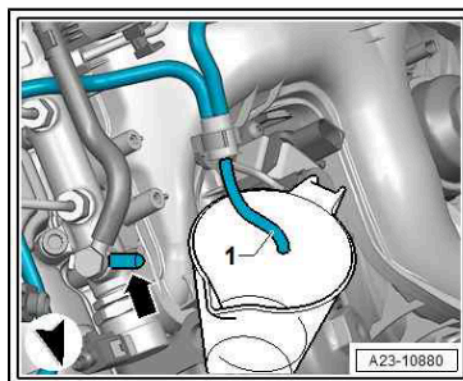


- Seal off open connection at banjo bolt with plug -arrow-.
- Hold fuel return hose -1- into a suitable container (lengthen hose if necessary).



Note

- ◆ Fuel return rate of injectors from fuel return hose -1- can be disregarded for this test.
- ◆ Fuel temperature above 10 °C.

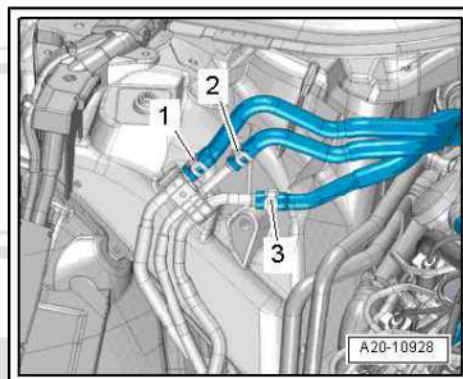


- Detach fuel return hose -2-.



Note

Disregard -items 1, 3-.



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- Seal off open return line connection with a test hose -2- and a hose clamp up to 25 mm - 3094- .
- Hold end of fuel return hose -1- in measuring container.
- Start the engine and run at idling speed.

Specifications:

- Return flow rate (engine start): 0 ml
- Return flow rate after 2 minutes: 0 ... 50 ml

If specified values are not obtained, fuel pressure regulating valve - N276- is defective.

- Secure fuel return hose to banjo bolt with new clip.

Bleeding fuel system and checking for leaks

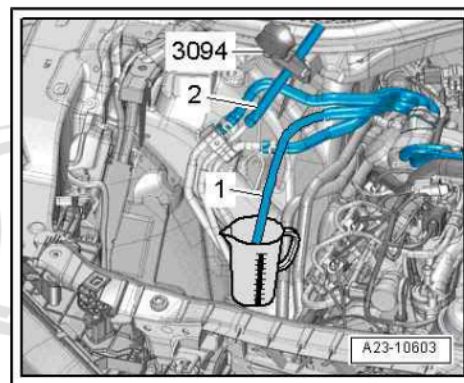
- Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

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- Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
- Install engine cover panel ➔ [page 31](#) .



Note

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

7.3 Removing and installing fuel pressure regulating valve - N276-



Note

- ◆ *The fuel pressure regulating valve - N276- maintains a constant pressure in the fuel rail and the injector pipes (high-pressure fuel circuit).*
- ◆ *It is not possible to start engine if fuel pressure regulating valve - N276- is defective.*
- ◆ *If the pressure in the high-pressure fuel circuit is too high, the regulating valve opens to allow some of the fuel to flow back from the fuel rail to the fuel tank via a return hose.*
- ◆ *If the pressure in the high-pressure fuel circuit is too low, the valve closes and seals off the high-pressure section of the system from the low-pressure section.*
- ◆ *The fuel pressure regulating valve - N276- has a deformable sealing lip and can only be used once. Do not install it for test purposes.*

Removing

- Pull off engine cover panel ➔ [page 31](#) .



WARNING

Risk of malfunctions caused by dirt.

♦ Observe ⇒ *page 2*.

- Clean thread and area all around fuel pressure regulating valve with engine cleaner or brake cleaner and dry.



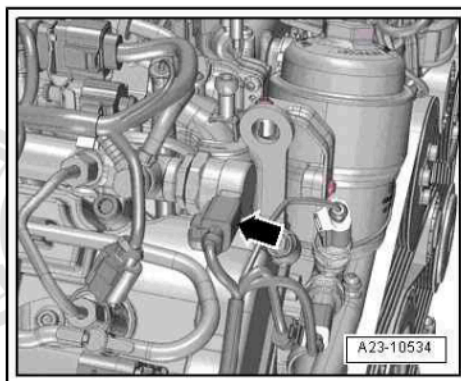
Note

- ♦ *Clean carefully; cleaning solution must not enter the electrical connector.*
- ♦ *Make sure no dirt gets into opening in fuel rail.*
- Remove banjo bolt for fuel return hoses.
- Unplug electrical connector -arrow- at fuel pressure regulating valve - N276- .
- Loosen union nut at regulating valve (counterhold at fuel rail). Then remove by hand.
- Remove dirt from thread and sealing surface of fuel rail using a vacuum cleaner. Do not use metal tools, etc.



Note

Seal off opening in fuel rail immediately with a suitable plug to prevent dirt from entering.



Installing

Installation is carried out in the reverse order; note the following:

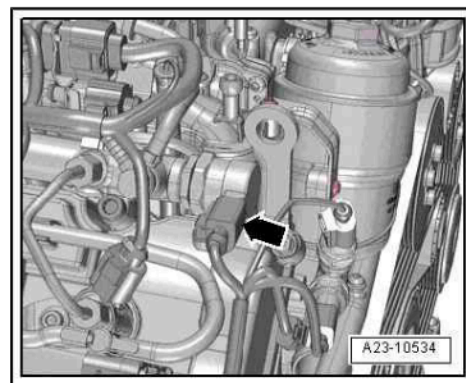


Note

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- ♦ *The fuel pressure regulating valve - N276- has a deformable sealing lip and no separate seal; it can therefore be used only once.*
- ♦ *Check that deformable sealing lip and thread on new fuel pressure regulating valve - N276- are not damaged.*
- ♦ *Check sealing surface at opening in fuel rail.*
- ♦ *The beginning of the thread, the deformable sealing lip and the O-ring of the fuel pressure regulating valve - N276- must be coated with diesel fuel.*

- Position fuel pressure regulating valve - N276- so that electrical wiring is not under tension when connector -arrow- is plugged in.
 - Tighten union nut on regulating valve in 4 stages (counterhold hexagon flats on housing):
 - Tightening torque ➔ [page 54](#)
 - Tighten banjo bolt for fuel return lines with new seals to 25 Nm.
- Bleeding fuel system and checking for leaks
- After installation, run engine at moderate speed for several minutes and then switch off.



 Note

The fuel system is "self-bleeding"; do NOT open the high-pressure connections.

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- Interrogate event memory and erase it if necessary.
- Switch off ignition.
- Carefully check the entire fuel system for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

After renewing high-pressure pump and/or fuel pressure regulating valve - N276- , adaption must be performed. Use ➔ Vehicle diagnostic tester.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

 Note

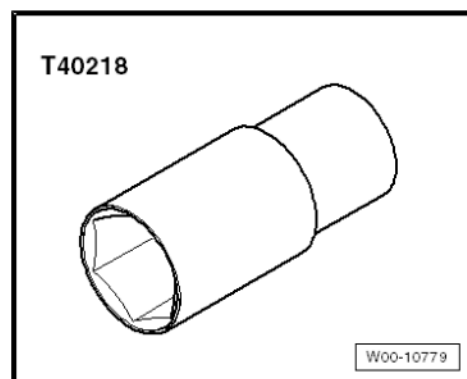
If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- After road test, interrogate event memory again.

7.4 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

- ◆ Socket, 27 mm - T40218-





- ◆ Torque wrench



Note

- ◆ *The fuel pressure sender - G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .*
- ◆ *Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.*
- ◆ *The fuel pressure sender - G247- has a deformable sealing lip.*

Removing



Caution

Risk of malfunctions caused by dirt.

- ◆ *Observe ➔ [page 2](#) .*

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- Pull off engine cover panel ➔ [page 31](#) .
- Clean thread and area all around fuel pressure sender with engine cleaner or brake cleaner and dry.



Note

Clean carefully; cleaning solution must not enter the electrical connector.

- Unplug electrical connector at fuel pressure sender - G247-
 -arrow-.
- Unscrew fuel pressure sender - G247- using socket, 27 mm -
 T40218- .



Note

An open-end spanner must not be used for loosening or tightening.

- Remove dirt from opening in fuel rail using a vacuum cleaner.
 Do not use metal tools, etc.

Seal off opening in fuel rail immediately with a suitable plug to prevent dirt from entering.

Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *If the deformable sealing lip and the thread of the fuel pressure sender - G247- are not damaged, the sender can be re-used once.*
- ◆ *Check that the deformable sealing lip and the thread on the new fuel pressure sender - G247- are not damaged.*
- ◆ *Check sealing surface at opening in fuel rail.*
- ◆ *The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be coated with diesel fuel.*

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- Screw in fuel pressure sender - G247- by hand.
- Then tighten fuel pressure sender - G247- to specified torque.

Note tightening sequence and tightening torque

- ◆ **⇒ Fig. "Fuel pressure sender -G247- - tightening torque" , page 55 .**

After installing fuel pressure sender - G247- , leave engine running at moderate speed for a few minutes when bleeding fuel system and then switch off again.



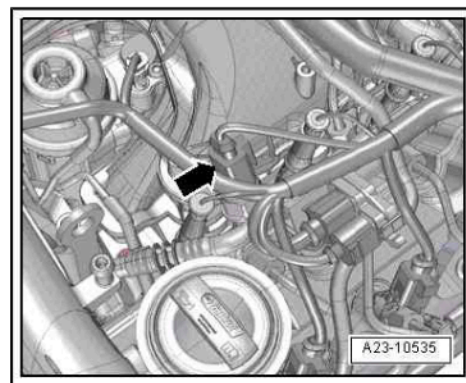
Note

The fuel system is "self-bleeding"; do NOT open the high-pressure connections.

- Interrogate event memory.
- Switch off ignition.
- Carefully check the entire fuel system for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

- After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.



**Note**

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

- After road test, interrogate event memory again.

7.5 Removing and installing pressure differential sender - G505-

**Note**

The pressure differential sender - G505- detects the amount of deposits in the particulate filter.

Special tools and workshop equipment required

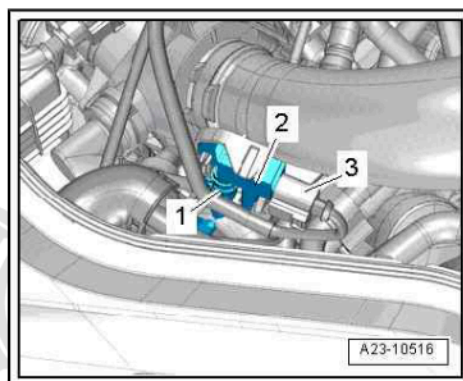
- ◆ Vehicle diagnostic tester

Removing

- Pull off engine cover panel ➔ [page 31](#) .

Procedure for vehicles with one turbocharger

- Unplug electrical connector -3-.
- Unclip pressure differential sender - G505- -2- from bracket and detach.
- If hose is to be disconnected from pressure sender, release hose clips (if fitted) and spray hose with silicone-free lubricant.
- To prevent hose connection from breaking off, carefully disconnect hose and keep it straight when pulling it off.



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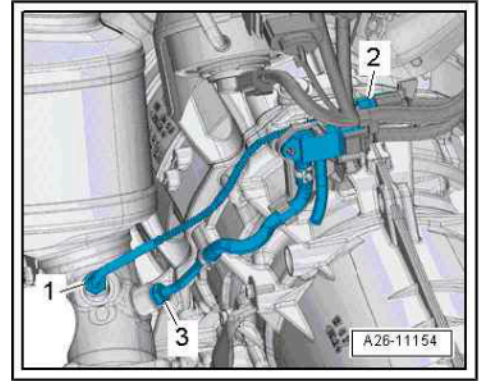
Procedure for vehicles with two turbochargers

- Unplug electrical connector -2-.
- Unclip pressure differential sender - G505- from bracket and detach.
- If hose is to be disconnected from pressure sender, release hose clips (if fitted) and spray hose with silicone-free lubricant.
- To prevent hose connection from breaking off, carefully disconnect hose and keep it straight when pulling it off.



Note

The short measuring line can be pulled off with the pressure differential sender - G505- removed.



Installing

Installation is carried out in the reverse order; note the following:

Tightening torque

- ◆ ⇒ ["8.1 Exploded view - Lambda probe, exhaust gas temperature control \(CLAA, CLAB, CDUC\)", page 90](#) .



Note

- ◆ *Blow through hose (towards particulate filter) with compressed air to remove dirt or ice (frozen condensation).*
- ◆ *Make sure that hoses are securely fitted and that there are no leaks.*
- ◆ *If pressure pipes have been detached from particulate filter, tighten connections to specified torque.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

Adaption must be performed after renewing pressure differential sender - G505- and/or particulate filter. Use ⇒ Vehicle diagnostic tester.

8 Lambda probes and exhaust gas temperature senders (CLAA, CLAB, CDUC, CKVB, CPNB)

⇒ "8.1 Exploded view - Lambda probe, exhaust gas temperature control (CLAA, CLAB, CDUC)", page 90

⇒ "8.2 Exploded view - Lambda probe, exhaust gas temperature control (CKVB, CPNB)", page 91

⇒ "8.3 Removing and installing Lambda probe G39 with Lambda probe heater Z19", page 93

8.1 Exploded view - Lambda probe, exhaust gas temperature control (CLAA, CLAB, CDUC)

Vehicles without SCR catalytic converter

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1 - Pressure pipe

- ☐ For pressure differential sender - G505-
- ☐ Tightening torque ⇒ Rep. gr. 26

2 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing ⇒ page 93
- ☐ New Lambda probes are coated with an assembly paste
- ☐ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- ☐ The assembly paste/ high-temperature paste must not get into the slots on the Lambda probe body
- ☐ 55 Nm

3 - Pressure differential sender - G505-

- ☐ 4.5 Nm
- ☐ Removing and installing ⇒ page 88

4 - Exhaust gas temperature sender 4 - G648-

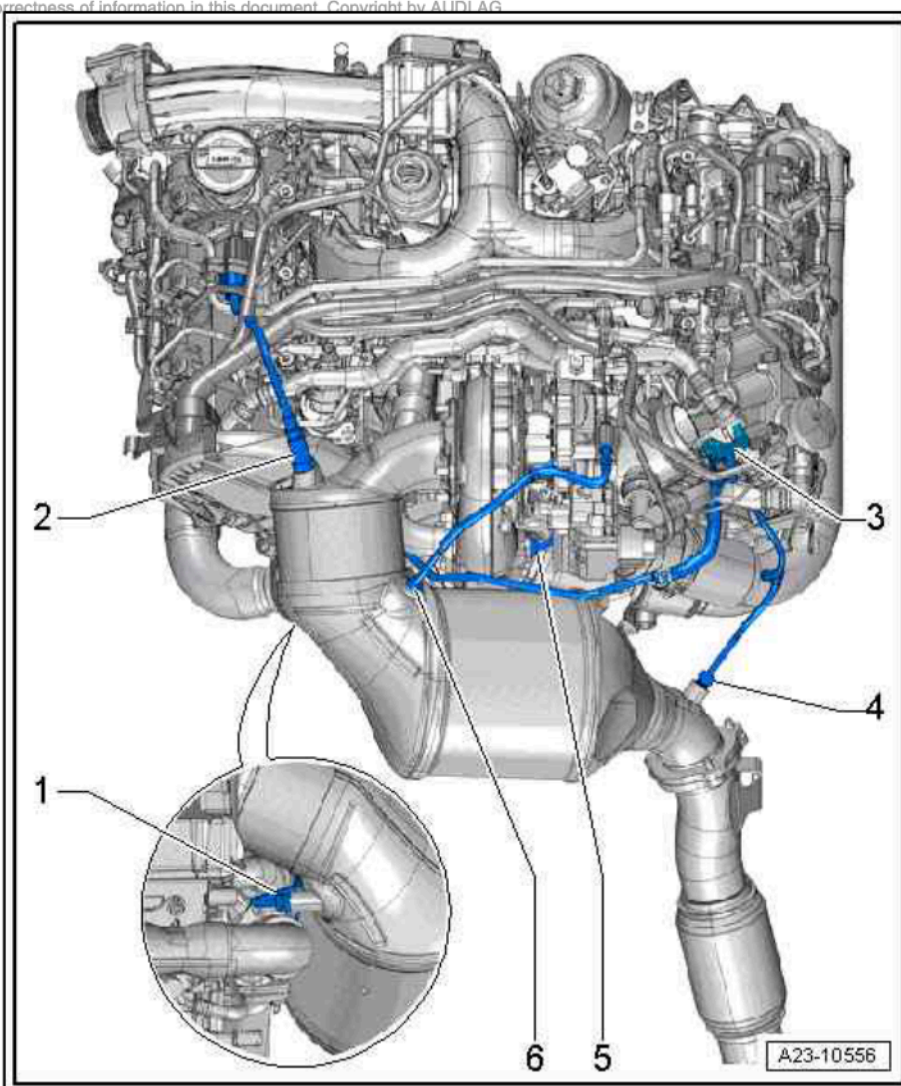
- ☐ Removing and installing ⇒ Rep. gr. 26

5 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing ⇒ Rep. gr. 26

6 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing ⇒ Rep. gr. 26



8.2 Exploded view - Lambda probe, exhaust gas temperature control (CKVB, CPNB)

Vehicles with SCR catalytic converter

1 - Nut

- ☐ 2 Nm

2 - Control unit for NOx sender 2 - J881- with NOx sender 2 - G687-

- ☐ Tightening torque for NOx sender 2 - G687- : 50 Nm
- ☐ Removing and installing ⇒ Rep. gr. 26

3 - Front exhaust pipe

4 - Particulate filter

5 - Exhaust gas temperature sender 3 - G495-

- ☐ Fitting location ⇒ [page 92](#)
- ☐ Removing and installing ⇒ Rep. gr. 26
- ☐ 45 Nm

6 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Fitting location ⇒ [page 92](#)
- ☐ Removing and installing ⇒ [page 93](#)
- ☐ New Lambda probes are coated with an assembly paste
- ☐ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste

- ☐ The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- ☐ 50 Nm

7 - Control unit for NOx sender - J583- with NOx sender - G295-

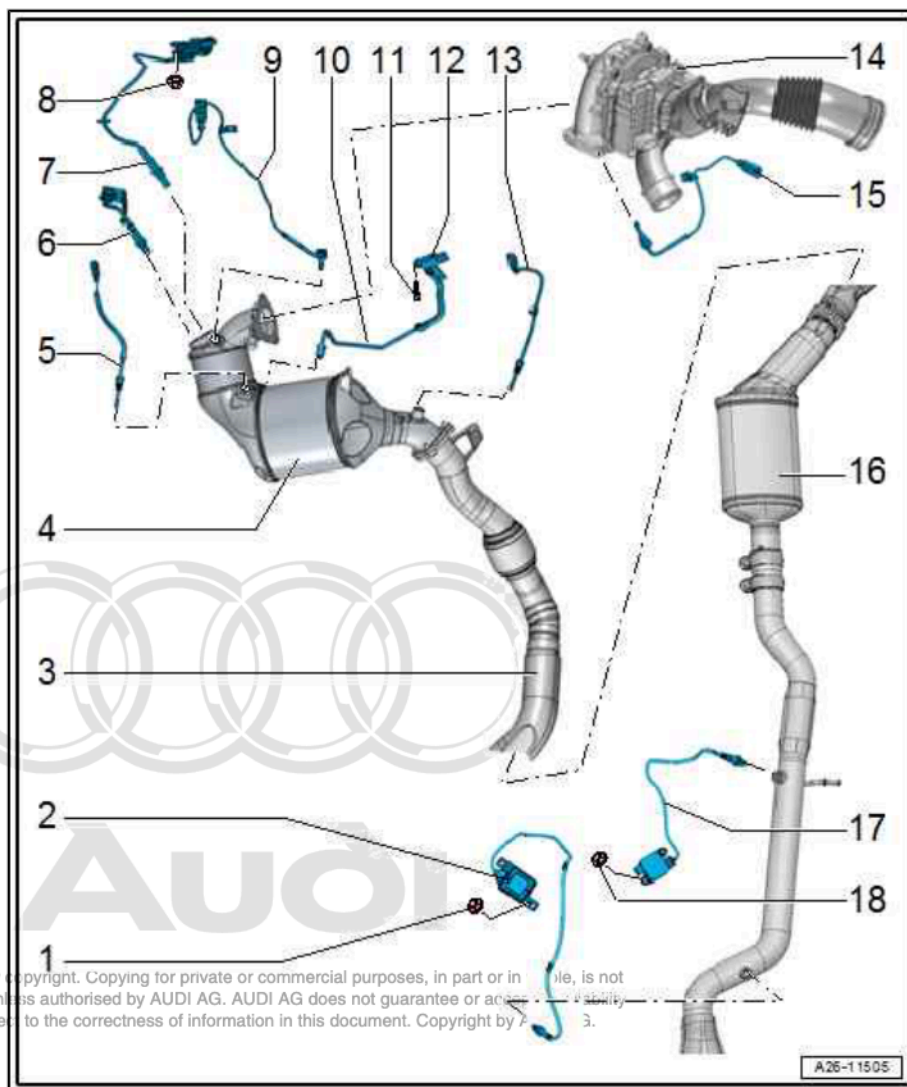
- ☐ Only installed on vehicles with engine code CPNB
- ☐ Fitting location ⇒ [page 92](#)
- ☐ Tightening torque for NOx sender - G295- : 50 Nm
- ☐ Removing and installing ⇒ Rep. gr. 26

8 - Nut

- ☐ Only installed on vehicles with engine code CPNB
- ☐ 2 Nm

9 - Exhaust gas temperature sender 2 - G448-

- ☐ Only installed on vehicles with engine code CPNB
- ☐ Fitting location ⇒ [page 92](#)
- ☐ Removing and installing ⇒ [page 93](#)



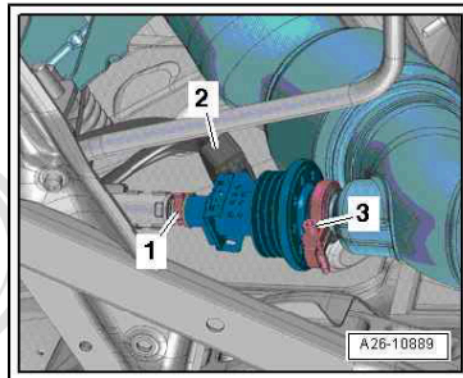
- ☐ 45 Nm
- 10 - Pressure line for exhaust gas pressure sensor 1 - G450-
 - ☐ Fit into particulate filter, clip into bracket and tighten.
 - ☐ 45 Nm
- 11 - Bolt
 - ☐ 4 Nm
- 12 - Pressure differential sender - G505-
 - ☐ Removing and installing ⇒ [page 88](#)
- 13 - Exhaust gas temperature sender 4 - G648-
 - ☐ Removing and installing ⇒ Rep. gr. 26
 - ☐ 45 Nm
- 14 - Turbocharger
- 15 - Exhaust gas temperature sender 1 - G235-
 - ☐ Removing and installing ⇒ Rep. gr. 26
 - ☐ 45 Nm
- 16 - SCR catalytic converter
- 17 - Particulate sensor - G784-
 - ☐ Only installed on vehicles with engine code CPNB
 - ☐ Removing and installing ⇒ Rep. gr. 26
- 18 - Nut
 - ☐ 2 Nm



Note

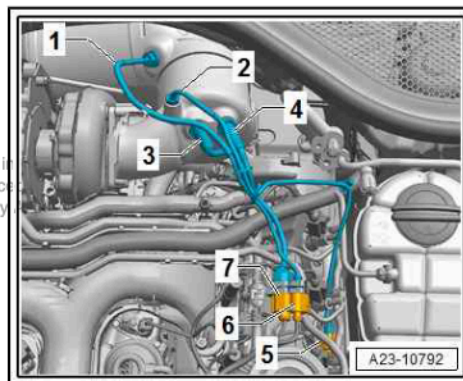
Injector for reducing agent - N474-

Removing and installing injector for reducing agent - N474- ⇒
Rep. gr. 26 Reducing agent metering system - vehicles with SCR
catalytic converter



Fitting locations of exhaust gas temperature sensors

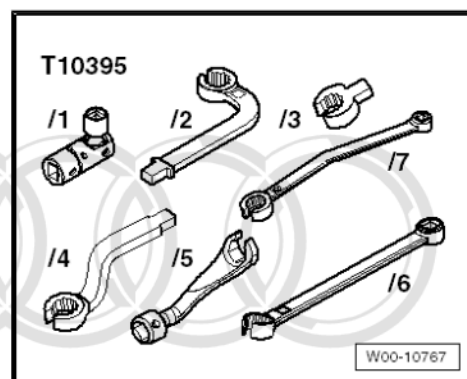
- 1 - Exhaust gas temperature sender 3 - G495-
- 2 - Exhaust gas temperature sender 2 - G448- (engine code CPNB only)
- 3 - NOx sender - G295-
- 4 - Lambda probe - G39-
- 5 - Electrical connector for exhaust gas temperature sender 2 - G448- (engine code CPNB only)
- 6 - Electrical connector for exhaust gas temperature sender 3 - G495-
- 7 - Electrical connector for Lambda probe - G39-



8.3 Removing and installing Lambda probe - G39- with Lambda probe heater - Z19-

Special tools and workshop equipment required

- ◆ Tool set - T10395 A-



Removing

- Remove engine cover panel.
- Unplug electrical connector -2- for Lambda probe - G39- .
- Unscrew Lambda probe - G39- -item 1- using a tool from tool set - T10395 A- .

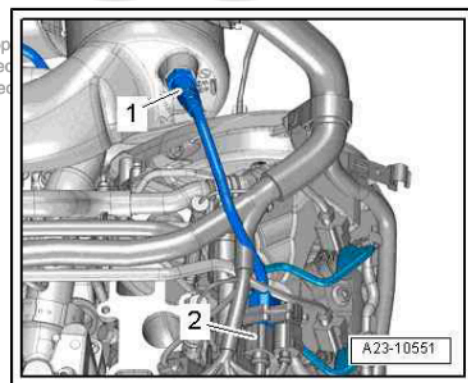
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ⇒ Parts catalogue .*
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*



Tightening torque

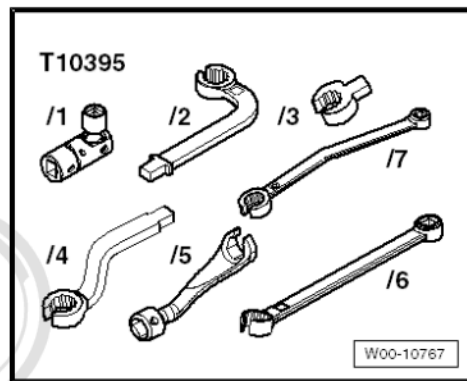
- ◆ ⇒ ["8.1 Exploded view - Lambda probe, exhaust gas temperature control \(CLAA, CLAB, CDUC\)", page 90](#)

8.4 Removing and installing exhaust gas temperature sender 2 - G448- (engine code CPNB only)

Special tools and workshop equipment required



◆ Tool set - T10395 A-



Removing

- Remove engine cover panel.
- Unplug electrical connector -5- from exhaust gas temperature sender 2 - G448- .
- Move clear electrical wiring.
- Unscrew exhaust gas temperature sender 2 G448-item 2 using a tool from tool set - T10395 A- .

Installing

Installation is carried out in the reverse order; note the following:

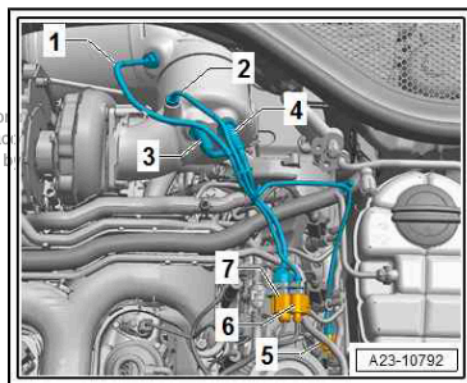


Note

Fit all cable ties in the original positions when installing.

Tightening torque

- ◆ ⇒ "8.2 Exploded view - Lambda probe, exhaust gas temperature control (CKVB, CPNB)", page 91



9 Lambda probes and exhaust gas temperature senders (CGQB)

⇒ "9.1 Exploded view - Lambda probe, exhaust gas temperature control (CGQB)", page 95

⇒ "9.2 Removing and installing Lambda probe G39 with Lambda probe heater Z19", page 96

9.1 Exploded view - Lambda probe, exhaust gas temperature control (CGQB)

1 - Exhaust gas temperature sender 4 for cylinder bank 2 - G649-

- ☐ Removing and installing
⇒ Rep. gr. 26
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ☐ 45 Nm

2 - Pressure pipe

- ☐ For pressure differential sender - G505-
- ☐ 45 Nm

3 - Exhaust gas temperature sender 3 - G495-

- ☐ Removing and installing
⇒ Rep. gr. 26
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

4 - Exhaust gas temperature sender 1 - G235-

- ☐ Removing and installing
⇒ Rep. gr. 26
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

5 - Lambda probe - G39- with Lambda probe heater - Z19-

- ☐ Removing and installing ⇒ [page 96](#)

6 - Exhaust gas temperature sender 2 - G448-

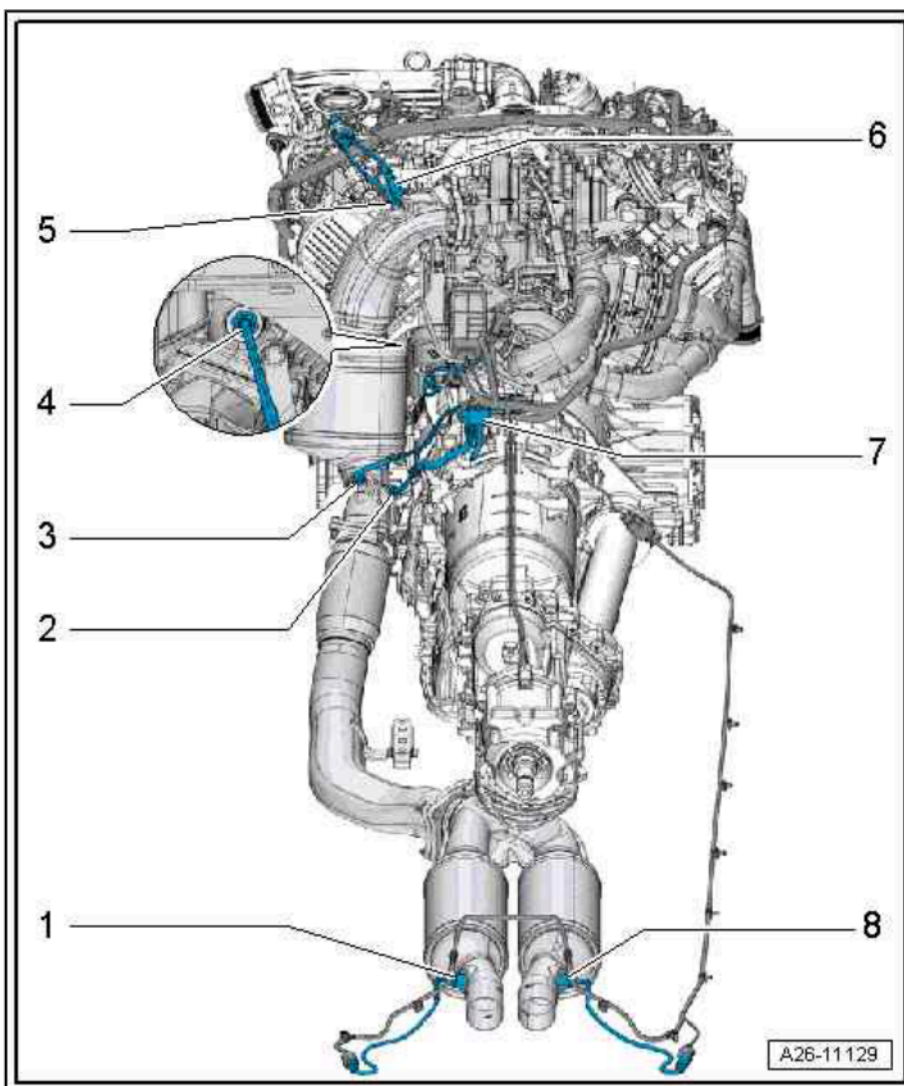
- ☐ Not fitted on all versions
- ☐ Removing and installing ⇒ [page 93](#)
- ☐ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

7 - Pressure differential sender - G505-

- ☐ Removing and installing ⇒ [page 88](#)

8 - Exhaust gas temperature sender 4 - G648-

- ☐ Removing and installing ⇒ Rep. gr. 26

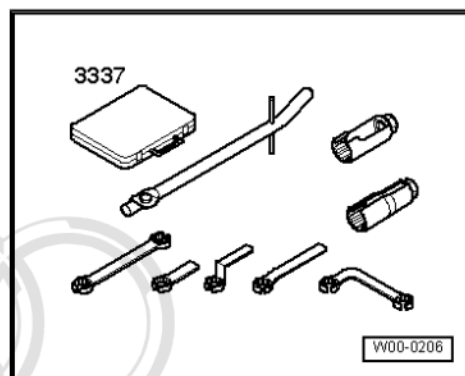


- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue

9.2 Removing and installing Lambda probe - G39- with Lambda probe heater - Z19-

Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set - 3337-



Removing

- Pull off engine cover panel ⇒ [page 31](#) .
- Unplug electrical connector -1- for Lambda probe - G39- .
- Unscrew Lambda probe - G39- -2- using tool from Lambda probe open ring spanner set - 3337- .

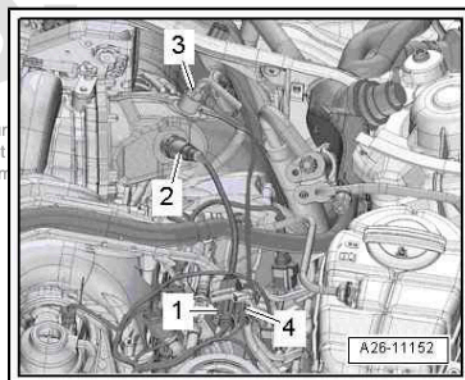
Installing

Installation is carried out in the reverse order; note the following:



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ⇒ Parts catalogue .*
- ◆ *When installing, the Lambda probe wiring must always be re-attached at the same locations to prevent it from coming into contact with the exhaust pipe.*



Tightening torque

- ◆ ⇒ ["9.1 Exploded view - Lambda probe, exhaust gas temperature control \(CGQB\)", page 95](#)

10 Engine control unit

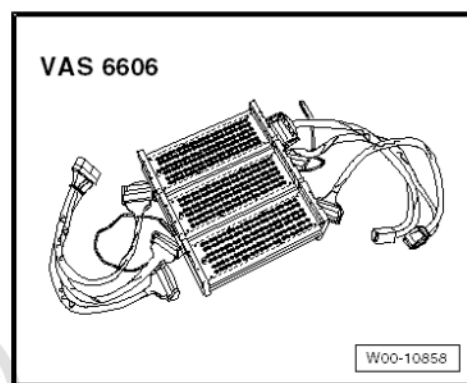
⇒ "10.1 Wiring and component check with isolator box VAS 6606", page 97

⇒ "10.2 Removing and installing engine control unit J623", page 98

10.1 Wiring and component check with isolator box -VAS 6606-

Special tools and workshop equipment required

- ◆ Isolator box, 198-pin - VAS 6606/1-1-
- ◆ Isolator box, 198-pin - VAS 6606/1-2-
- ◆ Isolator box, 198-pin - VAS 6606/1-3-
- ◆ Sheets -VAS 6606/1-1-
- ◆ Sheets -VAS 6606/2-1-
- ◆ Sheets -VAS 6606/3-1-
- ◆ Set of cables -VAS 6606/7-1- and -VAS 6606/7-2-



Note

- ◆ *Always make sure that the cables are properly connected.*
- ◆ *Do not use damaged or worn tools and accessories.*
- ◆ *Observe operating instructions.*
- Connect both cable sets -VAS 6606/7-1- and -VAS 6606/7-2- to the three isolator boxes -VAS 6606/1-1-, -VAS 6606/1-2- and -VAS 6606/1-3-.
- Use the following sheets:
 - ◆ -VAS 6606/1-1- for isolator box, 198-pin - VAS 6606/1-1-
 - ◆ -VAS 6606/2-1- for isolator box, 198-pin - VAS 6606/1-2-
 - ◆ -VAS 6606/3-1- for isolator box, 198-pin - VAS 6606/1-3-

Note

Make sure that all plug-in bridges are inserted completely in all isolator boxes.

- Connect earth strap to an isolator box and to an earth point on the vehicle.
- Remove engine control unit ⇒ page 98 .

- Connect engine control unit to cable set -VAS 6606/7-1- .
- Connect vehicle wiring harness to cable set -VAS 6606/7-2- .

The connection on the engine control unit consists of a large and a small connector.

The large connector has 105 pins and is assigned to the sheets for the isolator box marked "A 1 to A 105".

The small connector has 91 pins and is assigned to the sheets for the isolator box marked "B 1 to B 91".

When a push-in bridge is pulled out, the corresponding wiring connection is disconnected.



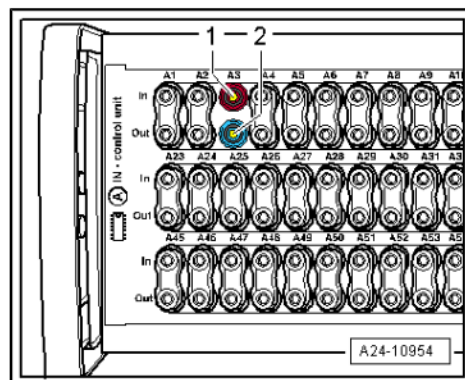
Note

- ♦ The "In" contact -1- (red socket) leads to the engine control unit.
- ♦ The "Out" contact -2- (blue socket) leads to the wiring harness.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions. Use ➔ Vehicle diagnostic tester.



Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining events saved in the memories must be dealt with so that all event memory entries can be erased.

10.2 Removing and installing engine control unit - J623-

Removing

- Before removing the engine control unit - J623- the adaption values of the injectors and the ash deposit mass must be read out. Use ➔ Vehicle diagnostic tester.

The adaption values for the injectors in the old (defective) engine control unit can be read out via the Guided Fault Finding or Guided Functions mode and can be stored as an electronic file in the ➔ Vehicle diagnostic tester.

- Switch off ignition and remove ignition key after storing electronic file containing adaption values.

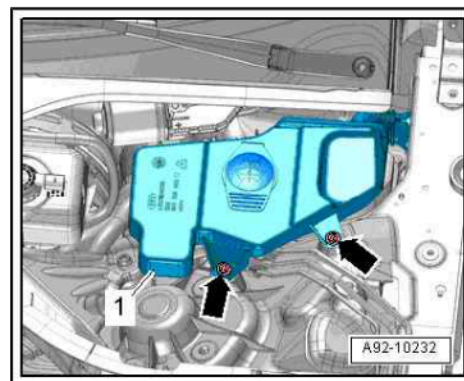


Note

If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, they must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

- Remove plenum chamber cover ➔ Rep. gr. 50 .

- Unscrew bolts -arrows- and pull filler neck out of washer fluid reservoir and through opening in body to right side.



- Release catch -arrow- and detach engine control unit - J623- -item 1-.



Note

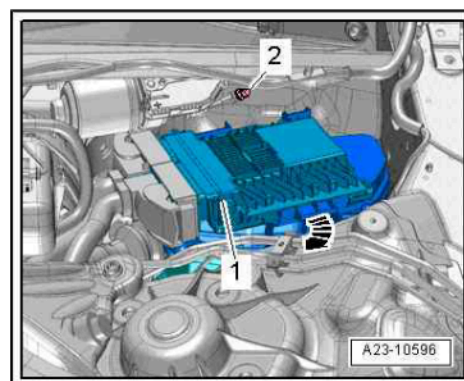
Disregard -item 2-.

Installing

Installation is carried out in the reverse order; note the following:

- After the engine control unit - J623- has been renewed, the "Injector delivery calibration" and the "Injector voltage calibration" must also be re-adapted in the engine control unit (these functions influence engine power and exhaust emissions).
- On vehicles with particulate filter the current mileage (km) reading must be stored in the engine control unit - J623- via an adaption procedure.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions. Use ⇒ Vehicle diagnostic tester.



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28 – Glow plug system

1 Glow plug system

⇒ [“1.1 Checking glow plug system”, page 100](#)

⇒ [“1.2 Exploded view - glow plugs, Hall sender, engine speed sender”, page 100](#)

⇒ [“1.3 Removing and installing glow plugs”, page 101](#)

⇒ [“1.4 Removing and installing engine speed sender G28”, page 103](#)

⇒ [“1.5 Removing and installing Hall sender G40”, page 104](#)

1.1 Checking glow plug system

- ◆ The glow plug system is activated via the automatic glow period control unit - J179- . The control unit is self-diagnosis compatible.
- ◆ A fault is stored in the event memory of the engine control unit - J623- if a fault occurs in the glow plug system.
- ◆ The procedure for checking the glow plug system is described in the “Guided Fault Finding”.
- ◆ For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit.
- ◆ Each glow plug is activated and diagnosed separately.



Note

- ◆ *Wait for 60 seconds each time after performing final control diagnosis of the glow period control unit. The ignition must remain switched on.*
- ◆ *If you do not wait for 60 seconds (if ignition is switched off and immediately switched on again), the glow plugs can be damaged (due to repeated pre-heating).*
- ◆ *The activation of the glow plugs is controlled according to coolant temperature.*

1.2 Exploded view - glow plugs, Hall sender, engine speed sender

1 - Sender wheel

- ☐ For engine speed sender - G28-
- ☐ Removing and installing
 ⇒ Rep. gr. 13

2 - Glow plug

Cylinder bank 1 (right-side):

- ☐ Glow plug 1 - Q10- ,
 glow plug 2 - Q11- , glow
 plug 3 - Q12-

Cylinder bank 2 (left-side):

- ☐ Glow plug 4 - Q13- ,
 glow plug 5 - Q14- , glow
 plug 6 - Q15-

- ☐ Removing and installing
 ⇒ [page 101](#)

- ☐ 12 Nm

3 - Electrical connector

4 - Bolt

- ☐ 9 Nm

5 - Hall sender - G40-

- ☐ Removing and installing
 ⇒ [page 104](#)

6 - O-ring

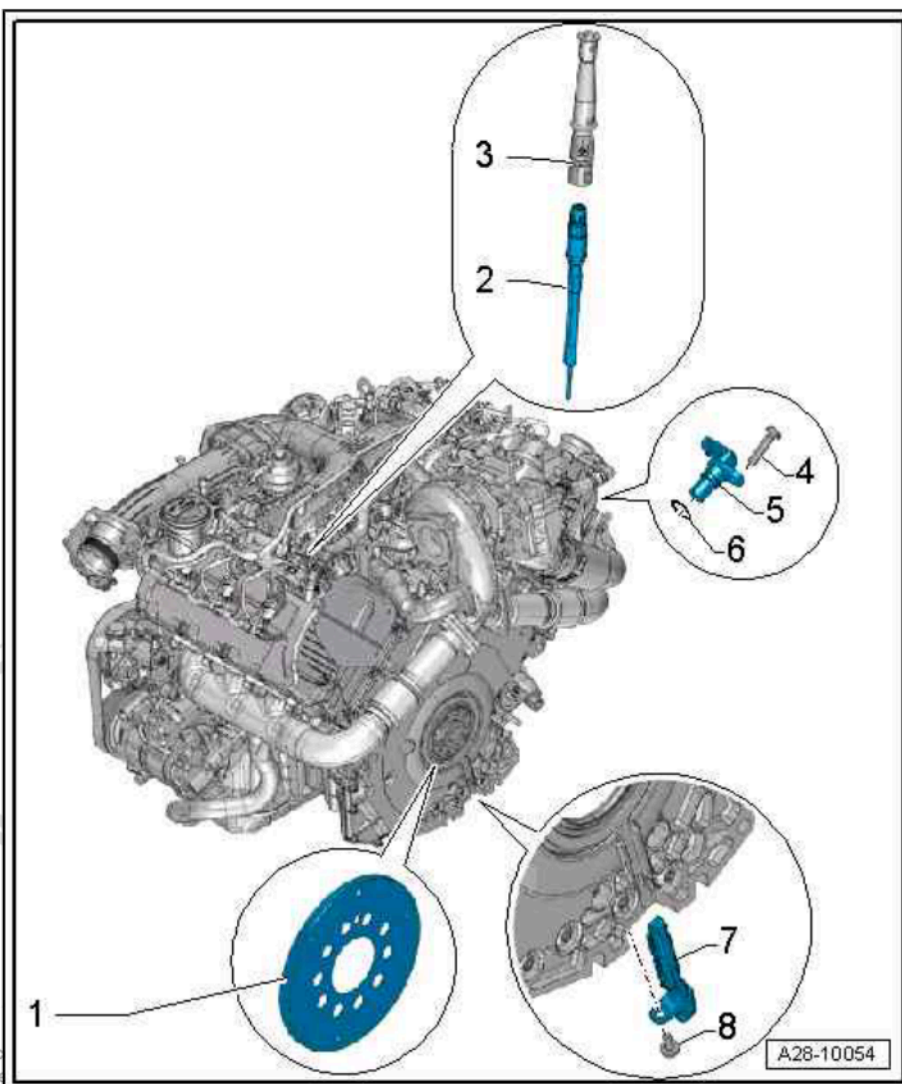
- ☐ Renew

7 - Engine speed sender -
 G28-

- ☐ Removing and installing
 ⇒ [page 103](#)

8 - Bolt

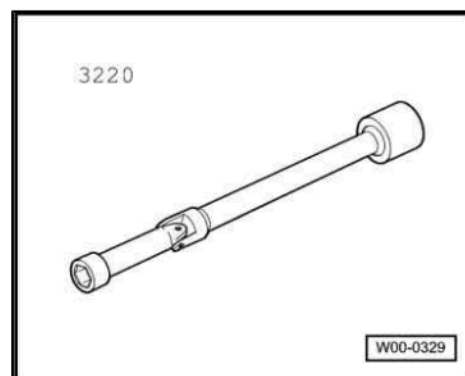
- ☐ 9 Nm



1.3 Removing and installing glow plugs

Special tools and workshop equipment required

- ◆ U/J extension and socket, 10 mm - 3220-



Removing

- Switch off ignition.
- Pull off engine cover panel ⇒ [page 31](#) .

- Detach glow plug connectors from glow plugs.
- Clean glow plug opening to make sure no dirt gets into cylinders.
- Clean glow plug openings in cylinder head; make sure no dirt gets into cylinder.

**Note**

- ◆ *Cleaning procedure:*
- ◆ *Use a vacuum cleaner to remove coarse dirt.*
- ◆ *Spray brake cleaner or suitable cleaning agent into glow plug apertures, let it work in briefly, and blow out with compressed air.*
- ◆ *Then clean the glow plug openings using a cloth moistened with oil.*

**WARNING****Risk of eye injury**

- ◆ ***Wear safety goggles.***

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- Loosen glow plugs using U/J extension and socket, 10 mm - 3220- .
- Then unscrew glow plugs carefully by hand or using a suitable hose. Keep the glow plugs straight while unscrewing.

Installing

- Fit glow plugs carefully by hand or using a suitable hose. Keep the glow plugs straight while screwing them back in.
- To tighten the glow plugs use special tool U/J extension and socket, 10 mm - 3220- with a suitable torque wrench.

Tightening torque

- ◆ ⇒ **"1.2 Exploded view - glow plugs, Hall sender, engine speed sender", page 100 .**
- Attach glow plug connectors correctly and make sure connectors are securely fitted.

The remaining installation steps are carried out in the reverse sequence.

1.4 Removing and installing engine speed sender - G28-

Removing

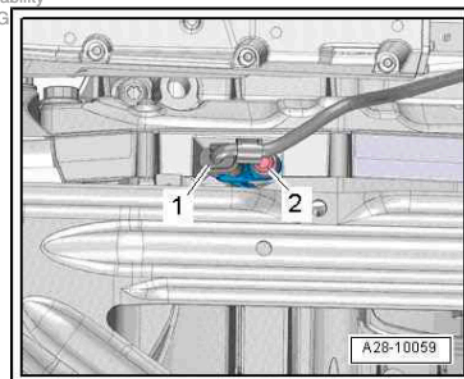
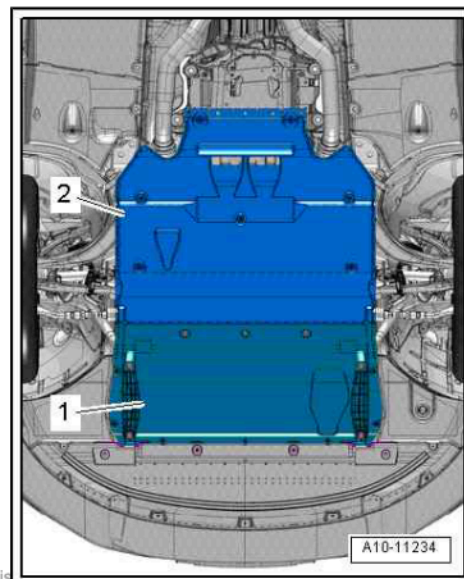
- Remove rear noise insulation panel -2- ➔ Rep. gr. 66 .



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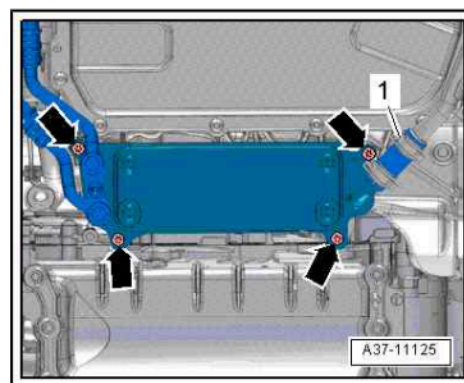
Vehicles with multitronic gearbox 0AW:

- Unplug electrical connector -1-.
- Unscrew bolt -2- and detach engine speed sender - G28- .

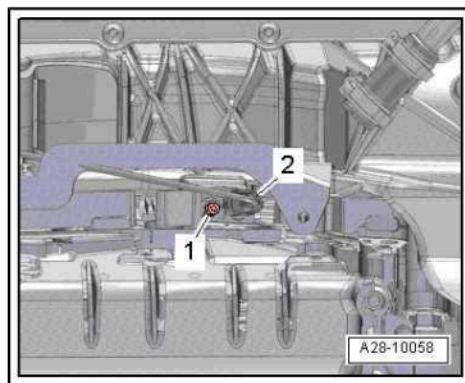


Vehicles with dual clutch gearbox 0B5:

- Remove bolts -arrows- and push ATF cooler slightly to one side.



- Unplug electrical connector -2-.
- Unscrew bolt -1- and detach engine speed sender - G28- .



Biturbo vehicles:

- Unplug electrical connector -2-.
- Unscrew bolt from engine speed sender - G28- -1- and remove engine speed sender.

Installing

Installation is carried out in the reverse order; note the following:

Tightening torque

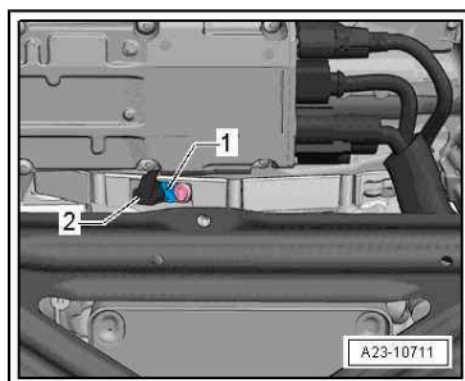
- ♦ ⇒ "1.2 Exploded view - glow plugs, Hall sender, engine speed sender", page 100 .

Vehicles with dual clutch gearbox 0B5:

- Install ATF cooler ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .

All vehicles:

- Install noise insulation ⇒ Rep. gr. 66 .



1.5 Removing and installing Hall sender - G40-

Removing

- Pull off engine cover panel ⇒ [page 31](#) .
- Unplug electrical connector -3-.
- Unscrew bolt -1- and remove Hall sender - G40- -item 2-.

Installing

Installation is carried out in the reverse order; note the following:

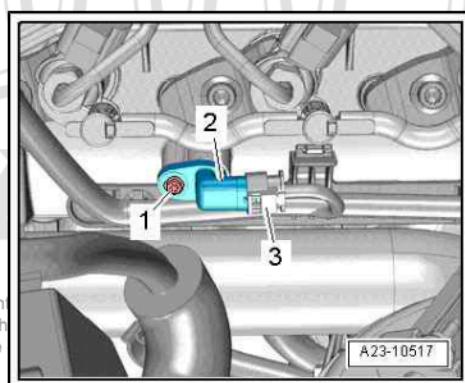


Note

Fit new O-ring.

Tightening torque

- ♦ ⇒ "1.2 Exploded view - glow plugs, Hall sender, engine speed sender", page 100 .



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